

Opportunities in
AVIATION



WALTER HINTON

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**WALTER
HINTON**



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CONTENTS

INTRODUCTION	ix
I. WHAT'S HAPPENING IN AVIATION	3
II. CAN I LEARN TO FLY?	31
III. FLYING JOBS IN AVIATION	67
IV. GROUND JOBS IN AVIATION	87
V. OPPORTUNITIES WITH AIRLINE AND AIR TRANSPORT COMPANIES	119
VI. INDUSTRIES CONTRIBUTING TO AVIATION	162
VII. HOW BUSINESS AND THE PROFESSIONS USE AVIATION	185

VIII. AIRPORT AND LANDING FIELD OPPORTUNITIES 208

IX. AERIAL EXPLORATION AS A FIELD OF
FUTURE OPPORTUNITY

235

LIST OF ILLUSTRATIONS

COMPARISON OF METHODS OF TRANSPORTATION	9
AIRWAY MAP OF THE UNITED STATES	13
PATH OF PLANE FLYING BY ANEROID ALTIMETER	17
THE U. S. ARMY PLANE <i>QUESTION MARK</i> REFUELED	27
STUDENT AND INSTRUCTOR IN DUAL CONTROL AIRPLANE	45
CONTROL LEVER POSITIONS	55
AN AERIAL MAP	83
ORGANIZATION CHART	99

A WRIGHT WHIRLWIND AIRCRAFT ENGINE	115
GROWTH OF AVIATION (CHART)	121
ORGANIZATION CHART	125
PACKARD AIRCRAFT DIESEL ENGINE	180
AERIAL EXPLORATION IN BRAZIL	239

INTRODUCTION

It is almost incomprehensible to that portion of the public which keeps abreast of the times, that there should still be people in civilized areas who doubt the importance of the position which Aviation has taken as an integral factor of modern life.

Morning and evening, the press recounts thrilling stories of this or that man's soaring flight in the extension of commerce or exploration or the swift despatch of mail, the spanning of an ocean or a continent, the discovery of a city lost thousands of years ago, the rescue of the storm-bound or the flood-trapped, the strengthening of international friendships.

On every motor trip into the country we discover new landing fields, new air line terminals, new flying schools, supply depots, factories, repair shops.

Aircraft expositions and races are being held at intervals in dozens of cities, where there are exhibited the latest developments that science and craftsmanship can devise in aircraft, accessories and engines from all over the world.

New types of highly developed planes, from the tiny one-passenger sport planes to giant multi-engined airliners capable of carrying dozens of passengers and tons of express and mail, are shown to record breaking crowds.

Though these spectators do not all fly today, their keen and active interest in Aviation, and their attendance at any air show, definitely indicate their desire to fly.

A glance at the Stock Market reports shows the listing of securities of a score of aircraft companies; the rotogravure sections of the papers are filled with Aviation photographs; the sports columns extol the excitement of air races and contests for which thousands of dollars in prizes are given.

It would seem, then, that nothing but ignorance of what is going on can excuse a denial of the achievements of the airplane or of its present great importance to modern life.

The airplane today is more highly developed and perfected than was the locomotive or the steamship or even the automobile at the same chronological stage of its evolution. It is, at this moment, the basis of an enormous and progressive industry resting solidly on the proven developments of aeronautical engineering, sound manufacturing practice, and healthy financing. Sooner or later, the dullest and most prejudiced must admit the airplane's significance in its industrial as well as its sociological and engineering aspects.

To insist that flying is not yet safe is to say that traveling by steamship, rail or automobile is not safe, for all of these involve the ordinary risk that attaches to any form of travel. A wreck is a wreck, whether it be of a steamship or an airplane. There is not nearly so much hazard in taking a trip in a licensed plane flown by a licensed pilot as there is in crossing Fifth Avenue

when the traffic light is against you. Yet thousands of jay-walkers thread their way among the mazes of speeding traffic every hour of the day and night, careless of a danger held in contempt through its familiarity.

In these advanced days of the automobile, it is not so spectacular to be crushed under the wheels of a motor truck as it is to be involved in an airplane accident. For that reason alone the airplane accident is "circussed" on the front page of your newspaper, while the motor accident is hidden away among the three columns of casualties on the inside of the last sheet. Conditions which might wreck an airplane are comparable to those which might wreck a ship, with this difference — that a half dozen may be lost in the former and several hundreds in the latter.

These are discoveries which the traveling public is making and assimilating with enthusiasm.

We are subscribing to scores of Aviation magazines, reading books and pamphlets and Government publications on the subject: we are seeing with our own eyes the magnificent strides that flying has made in the past few years, and we are seizing the opportunities which it offers for distinguished and interesting work in all of its countless ramifications. We are learning to fly.

When we hear the familiar sound of a plane high overhead, we still stop to look up, we still sigh the sigh of envy and admiration, but we no longer feel the throb of anxiety or the fear of quick disaster that we experienced just yesterday. But we are coming to realize that the old idea of Aviation as meaning merely a plane and a pilot is a thing of the past. We know the skill, the

scientific research, the labor that have gone into the building of that plane and the careful training and drilling of the man who pilots it. We are sure of the stability and strength of an American airplane because, before any plane or engine can be sold to the public, it must have been awarded an Approved Type Certificate by the Aeronautics Branch of the Department of Commerce, which certifies that it is properly constructed. We know that hundreds of men and vast sums of money have been used in financing, building, promoting, selling, and operating our planes and air lines on a sound business basis.

Flying is but a small part of Aviation as we know it today. It is no more necessary that a man be a pilot to be a success in this field, than that he be a locomotive engineer to achieve success in the railroad industry. Of the thousands of men and women who are at work in this new industry, less than five percent are actual flyers.

Who then, are these others in Aviation? What is the nature of their performance? What are their problems? How promising is their future? How did they find their way into the field? And how can we emulate them?

It is the purpose of this book to answer these questions by showing the wide variety of work necessary to the Aviation Industry as a whole; by detailing not alone the flying and servicing phases, but all of those which involve engineering and design, building, repairing, selling and equipping planes, and general service to the patrons of air travel. There is a place in Aviation

for almost every kind of worker. The field is uncrowded, opportunities are unlimited.

Manpower is the greatest problem which confronts Aviation today: its greatest need is a sufficient body of intelligent and skillful men and women to carry on the innumerable and complex divisions of the industry—the creation of a brilliant and enthusiastic personnel.

Toward this end I have tried to give a clear statement of facts undistorted by fantastic prophecy.

Aviation is shown as it is today, the facts and figures quoted being taken from accurate and reliable sources. I have not relied solely on my own opinions and my own knowledge, but have consulted experts in every branch of the business, both governmental and private.

In only one particular have I ventured into the realm of prophecy, and there my guess is as good as that of any other man who is studying and living this great adventure.

I believe that Aviation is just beginning the greatest phase of its development. I believe that the very *need* of its strangely individual work planted the seed of its being and insured the rapidity of its growth.

We cannot foresee the discoveries that man will make in the *method* of flying, nor the lines along which his dreams will carry it. But I feel that the next and imminent chapter in the history of Aviation's progress will overshadow all the achievements of the past, and that the airplane will prove to be the great single influence in molding the life of man in this great Mechanical Age in which we have the good fortune to be living. We can only hope to stay here long enough to see the great

wings of the Future spreading their pinions for the greater happiness of all the nations of the Earth; employing their swiftness, their strength, their safety in carrying cargoes of express and humanity, messages of friendship, lessons in international understanding, proffers of Peace.

Chalter Winton

WASHINGTON

NOVEMBER, 1929

**OPPORTUNITIES
IN
AVIATION**

CHAPTER ONE

What's Happening in Aviation

IN 1836, the Chief of the United States Patent Office handed in his resignation, stating that, though he enjoyed his work, his conscience would not permit him to accept his salary from the people under false pretenses. Every conceivable idea and invention had been patented, he maintained; there was nothing left for him to do.

On December 17, 1903, a telegram from Manteo, North Carolina, proclaimed to the world that the impossible had been accomplished — that man could soar in the air like a bird.

Between 1836 and 1903, the sewing machine, moving picture camera, telephone, talking machine, radio and automobile had been invented. The world had embarked on the greatest mechanical age in history. On the very threshold of this new era, the Patent Officer had closed his eyes, had turned his back on the future, claiming that there were no more ideas to be patented.

That telegram in 1903 shows how deluded even an

honest man can be. The mental attitude of self-complaisance, of "let well enough alone," has never contributed to the progress of the world or the betterment of civilization. The pessimist and doubter have never done anything but hamper the movements of farseeing pioneers.

That clumsy, kitelike affair in which man made his first flight in a heavier-than-air machine that rose from the ground under its own power, was the result of the vision of Wilbur and Orville Wright, and of their unswerving determination to make that vision a reality.

These two serious-minded workmen refused to be daunted by the derision of the natives of the barren shores around Kitty Hawk, North Carolina. Neither were they discouraged by the scorn of those learned scientists who demonstrated, in long discourses filled with so-called scientific proof, that man could not fly in a heavier-than-air machine. Nor were they disheartened by the fate to which they were consigned by religious fanatics, who maintained that God had limited the power to fly to birds, angels and devils, and that any mortal who attempted to fly would most certainly be dashed to earth by an Olympian thunderbolt.

The Wright brothers went doggedly ahead with their work, experimenting with materials, developing power

plants, trying out new designs. And on December 17, they were ready — they had overcome insurmountable obstacles and had rallied after stunning reverses.

When Orville Wright climbed into the pilot's seat of this curious contraption, started the crude and feeble gasoline engine, grasped the controls, advanced the throttle, he began the first sustained free flight ever made by man in a heavier-than-air machine that rose from the ground under its own power!

This daring flight in a clumsy, underpowered machine, marked the birth of a new era. It was the beginning of the Age of the Air.

Since this flight of the Wright brothers, who devised "Wing-Warping," or lateral control (later developed into the present day Aileron control), there has been no basic improvement in the principle of heavier-than-air flying machines except the devising of the autogiro, which has not yet been developed commercially. Developments have been largely confined to refinement in design of airplanes, to the perfecting of improved power-plants and the fabrication of lighter, stronger materials.

In spite of public doubt and suspicion, Aviation has forged steadily ahead. Great things have been accomplished. Men who were once regarded as dare-devils,

risking their lives in flimsy flying machines, have become internationally known captains of this new giant industry. Big Business, convinced that the airplane is safe and economical, has placed millions of dollars in the hands of experienced airmen, who have been enabled thereby to develop the reliable and efficient airplanes of today.

From the small bicycle repair shop in Dayton, where Orville and Wilbur Wright made their first plane, the aircraft industry has grown into huge modern factories, covering acres of ground and employing thousands of men. The growth in size is no more startling than the advances made in actual flight. When the Wright Brothers made that first flight, lasting only twelve seconds, it was shouted to the world in headlines half a foot high. Today, when a plane remains in the air, in continuous flight, for longer than three weeks, the name of the man who made that flight is forgotten within the month!

When the Wright Brothers flew a few hundred feet, the world applauded. Today, non-stop flights of thousands of miles attract scant interest.

Even in this day of miracles, there are probably some who believe that man and science have completed their mastery over Nature. But I am confident that

those men and women who are really keeping abreast of the times and understand what is being accomplished in the realm of science, are convinced that we have not much more than crossed the threshold — that the coming years will see inventions and discoveries that will outshadow even the remarkable achievements of man in the recent past.

Those who are familiar with the trend in Aviation today cannot help but realize that the first twenty-five years of Aviation history, remarkable as they have been, are but a foreshadowing of the tremendous development that will arrive within the next twenty-five years or even within the next decade.

Aviation has seen the building of the Panama Canal, the making of the tungsten lamp, trans-Atlantic telephony, radio, transmission of photographs by wire, and television. With these epoch-making mechanical developments, Aviation has grown out of its baby clothes into the long trousers of what is fast becoming one of the world's most important industries.

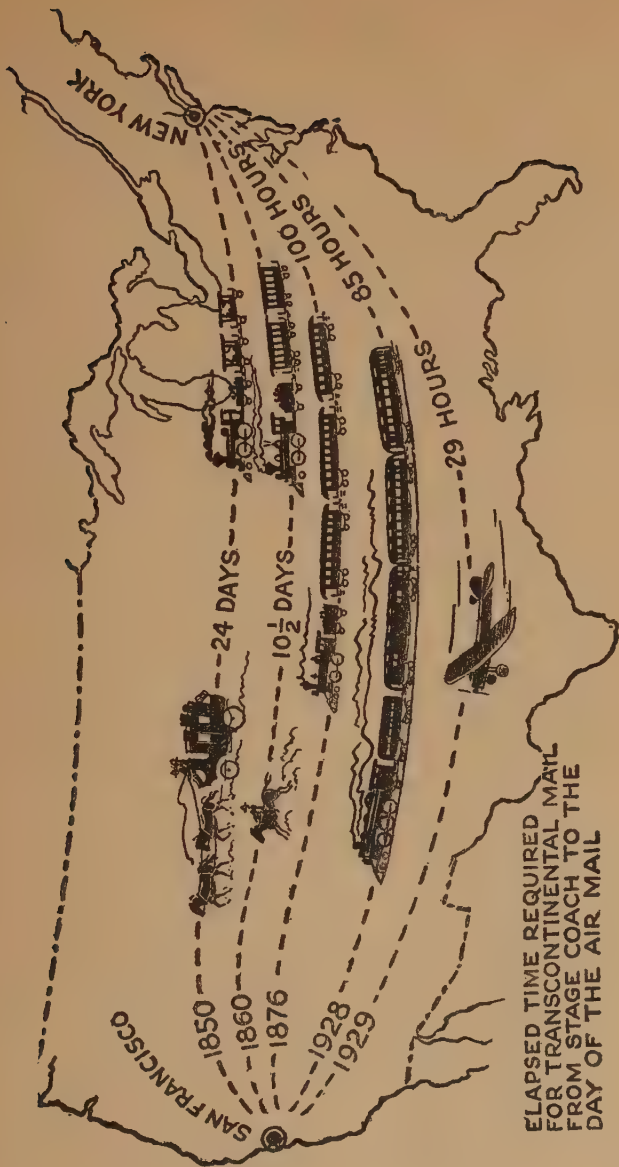
Not only have twenty-five years of Aviation growth, sponsored until very recently by a few hardy pioneers, seen the establishment in America of transcontinental air passenger, express and mail service, but they have also seen a one thousand percent increase in airplane

production for private ownership, a fifty percent reduction in air mail postage rates and great forward strides made in the solution of Aviation's preeminent problem — safety. A recent survey of commercial flying disclosed that there were but two deaths to passengers in five million miles of flight — a distance greater than two hundred times around the earth at the equator.

Having demonstrated its practicability, its safety and its economy, Aviation has now come into its own and its operations are on a large scale. Today, it is a billion dollar industry, with plenty of capital back of it. Great financiers and small investors alike are buying the stocks of the great organizations engaged in commercial Aviation activities.

Until recently almost the entire production of aircraft was absorbed by the various nations for their military requirements. But today those manufacturers who are still limiting their output to military types of aircraft are being outdistanced by progressive firms that are producing airplanes for commercial and private use.

Every newspaper and magazine is full of Aviation, because it is still news. Aviation is doing more to change our mode of living than any other one factor. The public is interested in Aviation, and in the application of airplanes to everyday life.



ELAPSED TIME REQUIRED
FOR TRANSCONTINENTAL MAIL
FROM STAGE COACH TO THE
DAY OF THE AIR MAIL

COMPARISON OF METHODS OF TRANSPORTATION
Courtesy of Popular Mechanics Magazine

Twenty-five years ago, a journey across the United States was a tedious undertaking. Even the fastest trains took several days and nights to go from New York to Los Angeles. Today, a fast airplane can cover this distance in two-thirds of a day, without stopping or refueling.

Letters sent by airplane from New York are delivered in San Francisco in the same time that other letters take to reach Chicago on the fastest mail train from New York. Post Office officials predict that, *all* first class mail will be carried by airplane. Flying mail clerks will sort the air mail in the plane, just as it is sorted aboard trains today.

Valuable and perishable articles are shipped by aerial express today in ever increasing quantities. Mountain trout, caught in Colorado streams on Wednesday, are packed in "refrigerator planes" and are served in Chicago and San Francisco hotels on Thursday.

No longer must a manufacturer carry in stock several days' supply of an expensive part. An airplane will bring, in a few hours, a supply that it would have taken days to obtain by train.

Distance has been annihilated by the airplane. The map of the United States has shrunk to one-third its

former size, for distance is measured no longer in miles, but in minutes.

Tremendous savings in money have been effected by the saving in time resulting from the use of the airplane. The business men of St. Louis, a city whose population is around 700,000, estimate that they are saving \$10,000,000 a year in interest on money in transit alone!

The New York Clearing House exchanges around \$1,000,000,000 a day. The interest on that sum is \$11,500 an hour. If the airplane could save only one hour a day in clearing that amount of money, it would save over one hundred million, seven hundred forty thousand dollars a year. Multiply that by the number of great cities in which huge sums of money are spent daily, and you will begin to have an inkling of the real value of airplanes to business and to the public. All this the airplane has accomplished by giving us speed.

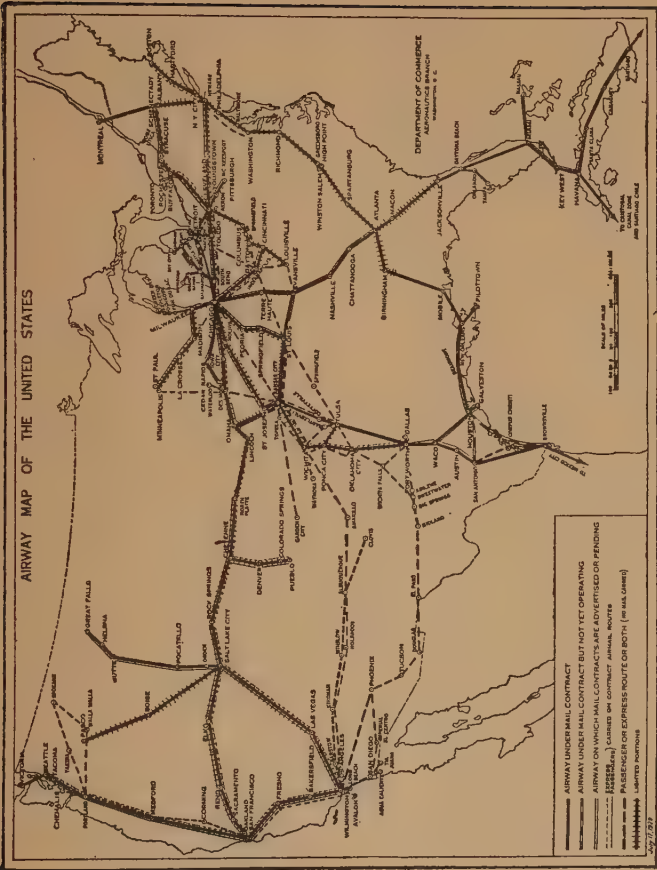
Along with speed, Aviation has developed safety. Not only by improving the design of airplanes themselves; by devising improved landing gear, more accurate controls, more reliable engines, but also by developing larger and smoother landing fields, by installing adequate weather reporting stations, by lighting

airports and airways, and by adapting radio to Aviation work.

Design of airplanes, of course, is greatly improved. Controllability, maneuverability and stability are far advanced over the Wright brothers' first flying machine. Engines are much more efficient, powerful and durable than they were ten years ago. Instruments to record engine-performance, fuel-supply, oil pressure, oil temperature and other factors of engine operation and flying conditions are more accurate than ever before. But the greatest steps toward making flying absolutely safe have been in the development of other instruments and devices. The Earth Inductor Compass is one important device that has solved some of the pilots, and navigators' problems.

Because of the great distances to be traversed in the United States, commercial flying has had to be done both day and night. Night flying operations brought many problems to the airline operator and the pilot. There was the difficulty of keeping on the course at night, when landmarks were indistinguishable. Then, when the pilot had reached his destination, it was almost impossible for him to find the landing field, and it was flirting with death to try to land his plane in the dark.

AIRWAY MAP OF THE UNITED STATES



AIRWAY MAP OF THE UNITED STATES
 Courtesy of U. S. Department of Commerce, Aeronautics Branch

These problems were partially met by the development of airway lighting.

First came the landing field floodlights. The pilot approaching a field blinked his navigation lights three times as a signal that he intended to land. The ground crew then turned on the floodlights, directed along the runway leading into the wind, lighting the field up as bright as day. The pilot landed in safety.

Other lights, too, were brought into use. White lights to line the boundaries of the field; red lights to mark all obstructions, such as radio masts, chimneys, high buildings, trees, wires and bad spots on the field itself. Green lights defined the sides of the runway, along which the bright beams of the floodlights were directed.

Then some planes were equipped with landing-lights which the pilot himself could turn on before he landed. These lights, carried on the plane, illuminated the field where there were no floodlights.

After that, beacon lights were installed all along the route. These are generally of the revolving type and consist of two beams — one white beam thrown almost parallel to the ground, a red light which flashes intermittently in a regular Morse Code signal, and an additional white beam directed straight up toward the

zenith. Airway maps show the locations of these beacons, and give the signal for each, so that a pilot who has lost his way can orient himself, on locating one of these beacons, by consulting his airway map.

The drawback to this system of lighting was that it did not work in foggy weather. The Neon light, possessing peculiar characteristics which enable it to penetrate fog, is an improvement over the ordinary incandescent light.

But the really important factor in conquering that greatest enemy of the flyer— fog — is the radio. It is eliminating fog as an element of danger. For, with the development of the Radio Range, or directional beacon, the pilot can fly through blackest night and thickest fog and still tell instantly by glancing at a small dial, the moment he deviates from his true course. The Radio Range comprises a series of broadcasting stations on the ground, some 200 miles apart.

Each station sends out a Radio beam, directed to a definite point of the compass. The pilot can ride this radio beam as a locomotive rides its tracks. The instant he starts to fly off his course, the indicator on the instrument board tells him that he is drifting to the right or left. All the pilot needs to do in order to arrive at his destination is to fly so that the Radio Range

indicator remains in "neutral." If air speed and ground speed were constant, no other "indicator" would be required, but they are not. Therefore, a radio field localizer beacon is placed at 50-mile intervals between the Radio Range sending stations. These devices are entirely automatic in their operation. Each localizer sends out its characteristic signal on a special wave length; when the pilot picks up a signal he knows exactly how far along his route he has gone.

Another radio device which will deprive flying of many of its dangers is the Radio Capacity Altimeter. This instrument tells the pilot at exactly what height he is flying above the ground directly beneath him. The old altimeter told the height above sea level. Not only was it necessary for the pilot to know the topography of the country over which he was flying, but it was also essential that he fly high enough to allow for inaccuracies in the altimeter, which was no more than an aneroid barometer graduated in feet, and subject to variation due to changing atmospheric conditions. Frequently a pilot was actually on the ground when his altimeter showed that he was, theoretically, two hundred feet aloft!

The Radio Capacity Altimeter, or Radio "Echo" Altimeter on the other hand, is very accurate. And the

PATH OF PLANE FLYING BY ANEROID -
 ALTIMETER READINGS AT 1500 FT ABOVE
 SEA LEVEL
 PATH OF PLANE FLYING BY RADIO-ECHO
 ALTIMETER READINGS GIVING ACTUAL
 HEIGHT ABOVE SURFACE



altitude readings change as the ground level beneath the line of flight changes from flat country to mountains or valleys. The diagram on the preceding page shows what might occur to a pilot flying through fog over strange country with the old aneroid altimeter, and how the new Radio "Echo" altimeter safeguards him under the same conditions.

EXPLANATION OF DIAGRAM

At A, with the old style altimeter, the pilot in the white plane sees that he is 3,000 feet above sea level. The pilot in the black plane, which is equipped with a Radio Capacity altimeter, also knows that he is 3,000 feet above sea level.

As they fly, however, the surface of the earth beneath them changes. At B, the two planes are still 3,000 feet above sea level; but the pilot of the black plane knows that he has reached hilly country, and that he is only 2,200 feet above the ground. At C, his radio capacity altimeter shows that he is over a hill, and is only 1,000 feet up in the air. So he climbs to a higher level, because his altitude above the earth has been constantly diminishing. He decides to keep at least 1,000 feet between him and the unseen ground below

him, and *his* altimeter keeps warning him to climb. The pilot of the white plane, on the contrary, flies blissfully on, not knowing that he is in mountainous territory. At D, he strikes the side of a mountain whose peak is about 3,500 feet above sea level — 500 feet above his line of flight. Naturally, he crashes. He has had no warning whatever of any change in the type of country over which he is flying.

These radio instruments have been brought to such a high state of perfection that a very interesting test flight was made successfully, in which the pilot could not see outside his cockpit at any stage of the flight.

This test flight was made by the Guggenheim Fund for the Promotion of Aeronautics and is described as follows:

“Completion of the first airplane flight with a cockpit entirely shut off from light was announced recently as the final successful test of a group of instruments designed to overcome the perils of flying through fog.

“Lieutenant James H. Doolittle, U. S. Army’s famous stunt flyer, seated in the darkened cockpit, took off from Mitchel Field and flew along the path of a directing radio beacon to a safe landing.

“The demonstration eliminates the last great hazard to the reliability of airplane travel and means that a

principle has been developed which, when eventually perfected for commercial use, will make the airplane more independent of weather conditions than any other form of transportation.

“The principal factors in making possible the accomplishment are a new application of the visual radio beacon, the development of an improved instrument for indicating the longitudinal and lateral altitude of an airplane, a new directional gyroscope and a sensitive altimeter, so delicate as to measure the altitude of the airplane within a few feet.

“In place of the natural horizon by means of which the pilot usually keeps his plane at a stable and safe flying attitude, and which would be invisible in fog, Lieut. Doolittle used an ‘artificial horizon’ in the form of a small instrument indicating to the pilot the longitudinal and lateral attitude of the airplane with relation to the ground at all times.

“With stability thus assured, the pilot was able to locate the landing field by means of the direction-finding radio. In addition to the long-distance radio beacon already in use at Mitchell Field and known to the country for some time, a beacon has been installed governing the immediate approach to the field, casting

a beam of some 15 or 20 miles in length in either direction.

“On the instrument board of the plane a visual radio receiver, tuned to the radio beacon, enables the pilot to determine the location of the beam and thus the landing-field.”

Remarkable though this feat may be to us today, it is no more than an indication of the practice we will adopt in actual commercial flying within the next few years.

Plane-to-plane and plane-to-ground communication by radio-telephone enable the pilot to get accurate information of the weather conditions before him. Data on atmospheric conditions are broadcast at very frequent intervals from the weather stations that dot all our principal airways. The pilot of a plane in the air can also talk to these weather stations. On giving them the number of his plane and the direction in which he is travelling, he receives an immediate report on the exact conditions which he will encounter — speed and direction of the wind, presence of fog, rain or snow, degree of visibility and the “ceiling” (or the height of the clouds) at the landing-field.

Radio-telephones are also a great convenience to passengers on transport planes equipped with these de-

vices. For the passenger can call the airport, get a telephone connection with family or friends, and inform them of the time of his arrival.

At present the Automobile Industry is taking advantage of the many innovations in engineering developed by Aviation. A well-known research engineer, in an article in *Popular Science Monthly* recently, made the statement that the present-day car was a lumbering, expensive contraption; that the future automobile would weigh less than a thousand pounds, cost less than a thousand dollars and have a speed of 100 miles per hour; and that all this would not be possible had it not been for the lessons learned from Aviation by automobile manufacturers.

A few years ago, we boasted of the great size and weight of our automobiles. Today, every manufacturer is trying his utmost to decrease the weight of his automobile; to develop smaller, lighter, more efficient motors; to lessen the length of his product without sacrificing "leg-room," to lower his car without cutting down "head-room," and to reduce resistance by improved streamlining of the body of the automobile. He is doing all these things because the airplane has taught him the value of light weight, and because smaller cars are more maneuverable. He has been able to accomplish

many of his aims through the solution of many similar problems by the aeronautical engineers.

Manufacturers of aircraft engines have developed lightweight metals with great tensile strength and high heat-resistance, reducing the weight of airplane engines from six or eight to less than two pounds per horsepower. Duralumin and other aluminum alloys were developed by metallurgists to meet the demands of Aviation and have been adopted by automobile engine manufacturers.

Designers of aircraft fuselages have shown the automobile body maker how to make a compact body without cutting down the clearances between seats and between the floor and top of the car, and have given the automobile designers altogether new principles of streamlining by which the resistance offered by the automobile body has been materially reduced.

While Aviation has taught the automobile industry a great many things and has shown it how to surmount a number of obstacles, there is one problem which Aviation cannot solve for the motorist.

We shall always have the 20-mile-an-hour-driver on the 45-mile-an-hour-highway, who almost forces the less patient driver behind him to pull out and take a chance on passing him. The developments in safety of planes

and reliability of motors, larger and improved air ports, improved planes with lower landing speeds and quicker take-offs, assure us that flying is rapidly becoming safer than motoring. There are fewer airplane accidents a year in the entire country than there are automobile accidents in any one of our larger cities.

As the automobile brought the suburb to the city, the airplane is extending that suburb, 50, 75, and 100 miles. Distance is no longer measured in miles, it is measured in minutes. Business men in the city will have their homes a hundred miles away and still be as near their offices as though they were living in the ten-mile suburb. The farmer will avail himself of the markets of the city where he may find ready sale for his products.

Today the owner of an automobile, in the attempt to get to the seashore or the country for a week-end's recreation, must fall into line with heavy traffic. He can travel only a relatively short distance in the limited time at his disposal. Also, the distance he can travel is exactly the same as that to which his thousands of motoring neighbors are restricted. The resorts which he and his neighbors can visit are limited to those within a radius of about a hundred miles.

Thus, the motorist will for years be subject to the

nerve-racking discomfort of driving along crowded highways to even more crowded resorts. He will return from his week-end "rest" more nervously exhausted than when he started.

The use of an airplane will eliminate all that. The ordinary week-end trip of the plane-owner will be to a distance of five hundred or a thousand miles. Within that larger radius will be many varied resorts, which the flying family will reach in a minimum of time, with no discomfort, with no thought of traffic problems on the untrammelled highways of the sky. Week-ends will be a pleasure, not an ordeal; and the tired business man will return to his desk on Monday morning rested and refreshed, invigorated for his battle for business.

Our two-week vacation trips will be proportionately extended. A trip to Europe, South America, Hawaii — to any land on the face of the globe — will supplant the thousand-mile automobile tour of which today's returning vacationist boasts.

By annihilating distance, Aviation will do its part toward wiping out international hatreds. We shall fly to other lands, learning the manners and customs of our foreign neighbors and becoming acquainted with the people. Mutual understanding and appreciation will replace the distrust and antagonism that is due, today,

largely to ignorance of the other nations' peoples and their ways.

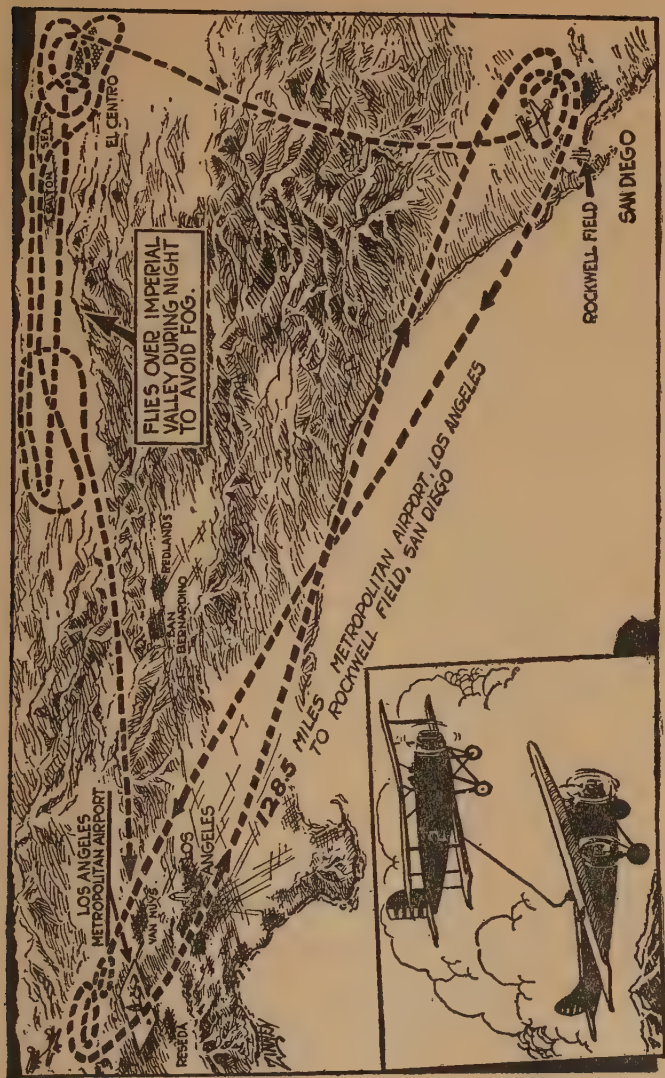
Travel will become an essential part of education. Languages will be taught by actual visits to the lands in which they are spoken; geography is already being taught by flying over the territory being studied; history will be impressed on the scholars' minds by showing them the scenes where history was made.

Flying Clubs and the Aviation Country Club are assured. Already, a chain of these country clubs has been started, one club in each of three cities. Members of one club are members of all the clubs in the chain — entitled to all the rights and privileges of resident members. Golf courses, swimming pools, tennis courts, bowling alleys and all the other appurtenances of a first-rate country club are included in the equipment of each of these Aviation Clubs, which have, in addition, landing-fields and hangars for members' planes.

Aviation is changing the mode of living of each of us. The rising generation will be a generation of flyers — of men and women who take easily and naturally to the air, who put the airplane to a myriad uses in business, and who derive from it a vast amount of pleasure.

Often acquaintances ask me:

“What good is accomplished by these trans-Atlantic



THE U. S. ARMY PLANE *Question Mark* WAS THE FIRST PLANE TO BE REFUELED IN FLIGHT
Courtesy of Popular Mechanics Magazine

flights? What is the use of an endurance refueling flight? How can long-distance flights benefit either humanity or aviation?"

My answer is, usually:

"What has racing done for the automobile?"

Where any competitive spirit exists or can be fostered, development of new methods is bound to come.

Practically every improvement in automobiles was developed first on the speedway. Engineering refinements are tested and tried in races. If they stand up under the gruelling punishment of a 500-mile race, if they better the performance of a racing car, it is safe to assume that they will stand up under ordinary pleasure-car use and will benefit the driver of the pleasure-car as greatly as they benefited the race-driver. Defects are exposed by the terrific strain of racing, and it is only when such defects are exposed, that engineers can strive to remedy them.

In the same way, these record-making flights benefit Aviation. Designs are proved, engines are tested rigorously in these flights. Instruments demonstrate their reliability and accuracy under trying conditions. And, too, these flights, more than any other factor, make the public "air-minded." The fact that two young men stayed aloft for over three weeks in a refueling endur-

ance record flight does more to remove the last vestige of doubt of the airplane's safety from the mind of the most timorous than all of the reports of the air transport companies and aerial service operators. While these reports show records just as remarkable as the endurance flight, they are not "front-page stuff" — and their cold figures are not very impressive to the casual reader, no matter how wonderful a record their analysis may reveal.

Our army and navy officers have learned the value of refueling as a weapon of national defense. Our bombing planes can now take off with a much larger load of bombs and a smaller load of fuel. When the fuel runs low, the plane may be refueled during its flight toward its objective.

Often weather or field conditions will not permit a bombing plane to take off if loaded to capacity. In such an event, a bomber can take off with a small load of gasoline and get its full supply of fuel in the air shortly after the take-off.

The fast through-plane, carrying bank drafts, money and fast mail in non-stop flights from coast to coast, will be met by another plane upon its approach to a city. The through plane will be refueled, documents and mail will be transferred from the fueling plane, and

the through plane will continue on its non-stop flight.

A plane will fly from coast to coast in 19 to 20 hours. This is but one illustration of what will be accomplished by the fast non-stop plane of the future. Compare it to the train-time of $4\frac{1}{2}$ to 5 days, as traveled today.

CHAPTER TWO

Can I Learn to Fly?

EARLY in the 15th century a man by the name of Gianbattista Danti, a professor of mathematics at Venice, Italy, made what was probably the first flight ever made by man. An historian of that city described the flight as follows:

“The day on which the nuptials of Paolo Baglioni were celebrated and many principal lords had congregated to honor him, and lances were being broken in the street under his windows, he (Danti) unexpectedly and with a mass of wings which he had fashioned in proportion to the gravity of his body, removed himself from a tower nearby and, emitting a whistle most horrible to hear, flew happily over the big square filled with innumerable people.”

According to the narrator, the flight ended with the collapse of the left wing and a fall on the roof of a nearby church, although Danti had acquired profi-

ciency by flying several times from the bluffs overlooking Lake Trasimeno.

On down through the ages men have attempted flight through the air. Many have failed, that is true, but in failing they learned many lessons, not the least of which is that flyers are made, not born.

While Aviation offers many opportunities to men other than pilots, the average man's conception of "getting into Aviation" is to become a pilot, to learn to fly. The ability to fly may not be a prime necessity but it is a valuable asset to every man who intends to devote his life to any one of the many branches of the Aviation Industry — whether it be piloting, selling, manufacturing or any one of the myraid other trades and vocations which play their important and essential part in the production, operation and maintenance of airplanes and air transportation service.

Because of this popular conception of Aviation, though, the average man, before going very deeply into the wide range of opportunities for a successful career in this new Industry, asks himself the question, "Can I learn to fly?"

The answer to that question is, in most cases, "Yes." Flyers are made, not born. While one man may possess a greater aptitude for flying than another,— due to

differences in keenness of judgment, in air sense, in training, in physical attributes and in quicker thinking and more delicate coordination of eye, mind and hand,— it is nevertheless true that the average man in good health *can* learn to fly, and fly well and safely.

Before he can get a license to take flight instruction, the would-be pilot must undergo a physical examination. Much has been written of whirling chairs, orientators and other devices for testing balance and sense of direction. But these devices can be disregarded. The tests themselves, while thorough, are relatively simple.

A great deal of the talk of these testing devices is the result of examinations given by the Army, Navy and Marine Corps. Military pilots must fly under conditions which commercial pilots seldom face.

Not only is a great deal of their flying composed of “aerobatics,”— of loops, Immelmann turns, barrel rolls, spins and dives and other maneuvers,— which the commercial pilot seldom uses; but the conditions under which they must perform these stunts are also different. They are under a tremendous strain, terrific excitement; they must not only fly their plane, but also fight at the same time. They may be fired upon by anti-aircraft guns, or pursued by an enemy plane; or they may be pursuing an enemy plane, or attacking

a ground force. In any of these circumstances, they must not only fly their plane, but handle their machine gun and perform many hair-raising maneuvers, all at the same time, to avoid being brought down by enemy planes or ground forces.

Therefore, combat flying demands more of the pilot than straight commercial flying, and an entirely different type of man is required. That is why military tests are so exacting. Many who cannot pass the military pilot's test can easily become good commercial pilots. The Department of Commerce examinations are just as selective for the demands of commercial work as the Army and Navy tests are for combat work.

First, the applicant must be normally sound in heart, limb and lung. Such diseases as epilepsy, tuberculosis, nervous and heart disorders bar him from passing the examination. A man subject to vertigo or to fainting spells cannot pass the examination; nor can a man afflicted with ailments which might cause a sudden weakening of a vital center of the body, or which might attack the nerve centers.

As far as general physical condition goes, then, the average healthy man who is free from diseases, and can go about his daily work in a satisfactory manner, can pass the examination with flying colors.

Next come psychological tests — tests of reflexes and reactions. The examining doctor asks a series of questions, apparently at random, about the likes and dislikes of the applicant; about his reactions to certain conditions. These questions are designed to test his temperament, and the average man of normal, mental and physical capacities need have no fear of them.

The “balancing” test is now very simple. While some fail to pass it, there is nothing in the test itself to fear. The applicant is blindfolded, and then is told to stand on one foot for a specified number of seconds. If he falls, it shows that the canals in the inner ear, in which there is a fluid that acts somewhat along the same lines as the carpenter’s spirit-level, have become hardened so that they do not record quickly and accurately changes in position. In old age, the walls of these canals harden and the nerves become deadened so that they do not transmit to and from the brain the messages which control muscular reaction to disturbed balance.

Hearing is tested next. The examiner retreats to a certain distance from the applicant and whispers to him or asks him to listen to the ticking of a watch. If the applicant can hear at a reasonable distance — say 20 feet — his hearing is acceptable. A pilot should not be deaf, because his ear must be able to hear varia-

tions in the operation of his motor; it must be able to catch the words of his student or co-pilot through the speaking tube (Gosport) helmet, or the messages received on his radio or radio telephone set. But hearing plays a much less important part than sight.

The eyes, therefore, are subjected to a more rigid examination. And eye-weaknesses bar more people from the passing of the tests than any other one defect. First, the ordinary eye-chart is used. If the applicant can read at 20 feet the required number of lines or letters on the standard chart, he is all right as far as plain *seeing* goes.

There are other eye-tests, however: for color-blindness — and the number of applicants who are color-blind is surprising. This affliction, if it can be called that, will bar a man from becoming a pilot, because a flyer *must* be able to distinguish colors. People who are color blind frequently confuse green and brown, or green and the various shades of red. They have difficulty, also, in distinguishing the various shades of green and, in a dim light and from a distance, might confuse a clump of trees in bud with an open field. At night, they may not be able to distinguish between red and green navigation lights, or might mistake a red danger signal for a green safety light. Then, too,

some airports use colored flags to signal to a pilot that the runway is clear and that it is safe for him to land his plane; or to signal that a plane is about to take off and that he must, therefore, keep away from the runway until the outgoing plane has cleared. By mistaking the colors of these flags, and by coming in to the runway when he had been signalled to stay away, the pilot might cause a collision:

If the applicant's vision is as good as the standards set as the limit by the Department (and these standards vary according to whether the examination is for Student, Private or Commercial Pilot), and if he is not color-blind, he is subjected to a perimeter test. By this test is determined how *wide* his range of vision is; that is, when his eyes are fixed on an object straight ahead, how far above, below and to each side he can see other objects. It is important that a pilot have a fairly large perimeter of vision, as it is often necessary for him to keep his eyes fixed on a landing runway straight ahead and at the same time to be able to perceive planes flying above or to one side of him.

Next, his "depth perception," or judgment of distance, is measured. On a sort of stage there stand two upright rods, one fixed and the other on a movable slide. While seated at a distance, the applicant pulls

the movable rod backward or forward until he has placed it, in his judgment, exactly beside (parallel to) the fixed rod. If he misses in three trials by an average error of more than 30 millimeters (or an inch and three-sixteenths), his judgment of distance is not good enough to permit his flying a plane. An error, in judging distance, of only a few feet often means the difference between a perfect three-point landing and "nosing over"—perhaps crashing! Double-vision is another eye-fault that bars many an applicant. A special device—the phorometer—tests not only double vision but also the ability of the eye to change its focus rapidly. Often a pilot must glance from a distant object to the instrument panel immediately in front of him. If the applicant's eyes do not change their focus quickly, then it might prove dangerous to let him try to learn to fly.

While it is necessary to have a vision of only 20-40 in order to qualify for a Student Pilot's license, the requirement for Limited Commercial and Transport Pilots is 20-30. In some cases, less than 20-30 vision is accepted provided the defect is corrected by glasses to 20-20, and provided the lenses in the pilot's goggles are ground to correct the defect.

Figures show that about 85 out of each 100 applicants for pilot's license pass the examination. Many

who are rejected the first time can be cured by operations, treatment or exercises of some kind, so that the defect barring them is remedied and they can successfully meet the requirements for license. As I said before, the *average* man in good health *can* pass the physical examination for pilot's license, and need have no fear of the outcome of the tests.

These physical requirements are set as a standard for the acceptance of new applicants for pilots' licenses. There are many men flying today who learned to fly years ago, before these regulations were put into effect, and who could not pass the examinations. However, they have been given licenses because the important point of the examination is to determine whether a man can fly safely and well, and the Department of Commerce is willing to license a pilot if he can show a record of safe flying which demonstrates his ability to fly in spite of physical disabilities.

After passing all of the tests, and finding that he is *physically* able to learn to fly, the would-be pilot has other questions to consider. That is, his original question, "Can I learn to fly?" has been answered in part only. Because in this question he implies not only "Am I *physically* able to fly?" but also "How can I learn to fly? Where can I learn to fly? Have I time to learn to

fly? Am I financially able? And what are my chances for coming through a flying course safely?"

I am going to take up each one of these points separately, and give you my own opinion, which is shared, as I have discovered in my talks with them, by a large number of prominent flyers and industrial leaders in Aviation like my friends Dick Byrd, Art Goebel, "Casey" Jones, Don Alexander, Roger Williams, Dick Depew, Clarence Chamberlin and others.

How Can I Learn to Fly?

To a limited number of men, various branches of the United States government, both civil and military, offer opportunities for learning to fly. Among these government agencies are the Coast Guard, the Army Air Corps, the Naval Air Service and the Marine Corps. The Coast Guard is under the Treasury Department, and candidates for this service are appointed to the Coast Guard Academy in much the same way that "Cadets" and "Midshipmen" are appointed to West Point and Annapolis. The Officers in the Coast Guard Flying Service must be regularly commissioned officers who have had two or three years of active duty and have completed the Course of Training given at the

Naval Flying School at Pensacola, Florida. As there are, at present, only five planes and thirty pilots in the Coast Guard Service, the opportunities of getting into this service are very limited. Occasionally an enlisted man can work his way into the flying end of the Coast Guard, but the odds against that are very great. Openings are extremely infrequent; written examinations for the service are rather stiff, and the number of flying jobs is small. While there are always possibilities of getting into the Coast Guard Air Service, the chances for the average man are limited. And, at best, acceptance for this service involves many months of waiting, study and delay.

Chances of getting into the Army Air Service Schools are not much better. In the first place, one of the prime requisites is two years of college education or its equivalent. If you have not had that, you might as well forget it. If you have, you can make application through the United States Army Air Corps, at Washington, District of Columbia. Once more your name is placed on a waiting list; once more you are asked to take rather rigid physical as well as written and oral examinations. The average man, again, stands small chance of entering this branch of the Air Service.

When the Army Air Service is open for enlistments,

it is sometimes possible to get into the Air Corps. But "Air Corps" does not mean, necessarily, flying. Army Officers in other branches are waiting to get into the flying end of the Service, and they take, naturally, precedence over enlisted men. The same conditions apply to the Navy. Applicants for the Air Services,—Army, Navy, Marine Corps and Coast Guard,—far out-number the vacancies.

The government Air Services give excellent training, possibly the best in the world, to those men who succeed in getting into their schools. But, unless your time is unlimited; unless you can wait for months for appointments, transfers, and so on; I would advise you to forget the Government Service and turn your attention to Commercial Flying Schools or Flying Clubs. Flying Clubs have become increasingly popular during the past two or three years. They offer an opportunity to learn to fly at rates considerably less than the average flying school can afford. There are certain pitfalls in the path of the Flying Club, however, which militate against the advantage they hold in cost over the organized school.

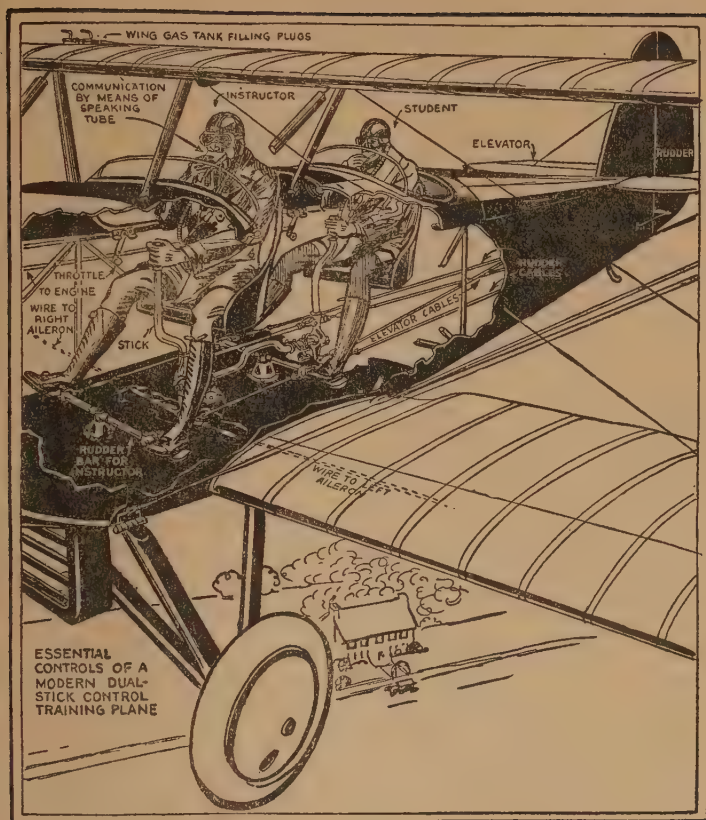
In the first place, it is not always easy to get twenty or thirty young men together who have or can secure the necessary money, (usually around \$400 apiece).

If a time-payment plan is offered to the club members, working capital may become exhausted because of the withdrawal of some members before they have paid their dues in full. This may result in the loss of the equipment bought by the club; in the resignation of the pilot-instructor hired to teach the club members, and so forth. About the only way, as I see it, to prevent the exhaustion of working capital is to discount it in advance. That is, to create a "reserve fund" of several hundred dollars which can be used for just such contingencies. Naturally, the reserve fund must be included in the expenses of the club, and it will therefore increase the amount to be paid in by each member.

Unless the club is backed by a strong organizer, a man with pronounced managerial ability, it is liable to go "on the rocks" financially and otherwise. Disagreement may arise over flying time, flying hours, disposition of the plane bought by the Club, methods of instruction, use of the plane as a source of income for the club, and a hundred and one other things. These disputes may result in the withdrawal of one or several members from the club, and the consequent loss of working capital, unless the club manager has enough ability, enough voice and power to settle the disputes equably and amicably.

Again, the club's plane may be wrecked, or destroyed by fire,—in which case, unless insurance is carried, the club's investment is a total loss. If insurance is carried, certain definite conditions must be met and maintained, observance of which may be difficult to enforce. Unless these conditions *are* enforced, however, the insurance is invalid. Here, again, a good manager is needed.

The usual airplane accident insurance policy does not offer full coverage for damage. That is, the insurance companies usually ask the club and the pilot to share in the cost of the damage. The usual amount "deductible" is \$300, divided between the club and the individual members on the basis that the club pays \$200 toward the repair of the damage, the individual member who was piloting the airplane at the time of the crash pays \$100, and the insurance company pays the balance. "Full Coverage" insurance is very expensive and is not favored by the insurance companies. With partial coverage, if there is an accident, the individual responsible may not be able to pay his share; or, at the time of the accident, the club treasury may be temporarily empty so that repair of the plane is delayed. Once more, there is room for argument; again there is the need for a good manager capable of han-



STUDENT AND INSTRUCTOR IN DUAL CONTROL AIRPLANE
Courtesy of Popular Mechanics Magazine

dling both the members and the finances of the club.

If, however, the club is well organized and well managed; if it has in its treasury sufficient capital to cover costs of operation; if the services of a good instructor are procured, and if the members secure their full quota of flying time without mishap, then the flying club offers a cheap way of learning to fly. For example, a young friend of mine organized a club in California. There were 22 members, each of whom paid in \$100 in cash upon joining the club, and agreed to pay in an additional \$200 at the rate of \$50 a month. A manufacturer was persuaded to put up \$800 because the club bore his name. With \$3000 in the club treasury as initial capital, the 22 young men bought a used plane with a rebuilt engine, and hired a "part-time" pilot. That practically exhausted the working capital, but as each club member had agreed to pay in \$50 per month,— a total of \$1100,— the pilot was paid, gas and oil were purchased, and hangar rent and incidental expenses were taken care of.

At the end of four months, each of the club members had learned to fly and had had from ten to fifty hours of solo time in the air. Most of them were eligible for a limited commercial pilot's license; and my friend, the organizer, had done his work so well that he had

built up quite a "pleasure-hopping" business and the club had more money in its treasury than was needed to give each member of the club the balance of the 50 hours solo required for a limited commercial license! At the end of six months, the club intends to disband. There will be 22 more limited commercial pilots available for the many jobs open, and each one of them will have his share of whatever the club gets from the sale of its plane to help carry him until he receives his first pay check in his new job.

That was a successful flying club — one of many. But it was well organized, well managed; and my friend, who was largely responsible for its success, is a "live-wire" who will, I am convinced, make a success of almost any sound proposition he tackles.

Before joining a flying club, then, you should look up the man or men back of it; you should scrutinize the plans for financing and managing the club; the reputation and ability of the instructor, and the reliability of the plane in which the flying instruction will be given.

Below are two tables, one showing the cost of membership in the club I have mentioned, the other the average cost in the National Aeronautical Association Flying Club.

FLYING CLUB

No. Members	Cost of Plane	Insurance	Operating	Total
	(3000)			
22	100.00	\$54.00	\$145.00	\$300

Note: \$800 of the Cost of the Plane was borne by the manufacturer under whose name the Club was run.

* N. A. A. FLYING CLUB PLAN

Each Member's Share of Club Operating Expenses					
Members	Cost of Plane (\$5,000)	Insurance	25% Reserve	Operating	Total
10	500.00	\$125.00	\$156.20	\$50.00	\$831.20
15	333.33	120.00	104.13	33.33	590.79
20	250.00	111.25	78.10	25.00	464.35
25	200.00	101.00	62.48	20.00	383.48
30	166.66	92.50	52.06	16.66	327.88

* Taken from the Flying Club Bulletin of the National Aeronautic Association, 1929.

Flying Schools

LAST, and most important, are the organized Commercial Flying Schools. To the man who can afford it, they offer undoubtedly the safest, quickest and best method

of learning to fly. For reasons which I will discuss in a subsequent section of this chapter, it will pay the average man to select a *good* flying school. In my judgment, it is better to take a private pilot's course at a first rate school than a limited commercial course at a third-rate one.

Costs of flying courses vary with the length of the course and the class of the school. Some good schools offer a private pilot's course, consisting of 10 hours

AVERAGE COSTS OF FLYING COURSES

Type of Course	Grd. Sch.	Flying Hrs.		Price		Leads to License:	Average Sal. (mo)
		Dual	Solo	ave.	low		
Pot. Pilot	2 wk	10	10	350	450	Private	—
Ltd. Coml.	2 wk	10	50	650	850	Ltd. Coml.	225
Transpt.	1 mo	10	200	2200	2500	Transpt.	600
Grd. Sch.	2 mo	—	—	100	225	Mechanic	185
	to 1 yr						

(These figures are based on Questionnaires sent during 1929 to 138 of the Leading Flying Schools in All Sections of the Country.)

flight instruction and 10 hours solo (or flying alone), for as little as \$350, giving with this course an elementary ground school training. Other schools offer the

same flying course for as high as \$650, the difference in price being represented by differences in the ground school work, in equipment, in types of ships used, in kinds of motors used both in the ground school and in the planes themselves.

In this table we see the low and average prices of the schools. In those schools charging more than the average price, there are usually certain advantages which justify the higher cost. Among these advantages are:

- (1) Better and more diversified types of flying equipment. Some schools give instructions in a number of different types of planes, from the 2-place open cockpit training plane to the 12-passenger transport plane, or in seaplanes.
- (2) Older instructors. Men who have had more flying time, who because of their vast and varied experience are able to impart what they know to their students; who have a more thorough knowledge of flying, etc.
- (3) Better hangar equipment.

- (4) Smoother and larger landing fields.
- (5) Location — nearer center of large cities.
- (6) Better living facilities for students.
- (7) More complete ground course.

On May 1, 1929, the United States Department of Commerce, Aeronautics Branch, published the School Supplement of the Air Commerce Regulations. In this bulletin they announced their plan for rating and inspecting Flying and Ground Schools.

In order to receive a Department of Commerce Rating, the flying school must maintain certain standards. It must not have more than 15 students for each plane; it must not operate more than 10 training planes at one time from a landing field smaller than 100 acres, nor operate more than 10 planes for each 100 acres; it must use only planes licensed by the Department of Commerce; its landing field must have 2000 feet of effective landing area in all directions, with clear approaches, or a certain number of runways; and it can employ only flying instructors who have passed a Department of Commerce Flying Instructor's Examination.

Students must be given a certain number of hours of dual instruction and solo, depending on the type of course selected by the student; and the type of instruction must be high enough so that nine out of every ten students who apply for the Department of Commerce License examination can pass the test.

Rules governing amount of dual instruction, methods of instruction and subjects taught are also in effect, so that a school rated by the Department of Commerce teaches its students enough to enable them to pass the pilots' examinations.

Under the rating plan, schools are grouped according to the courses they teach — Ground, Private Pilot's, Limited Commercial and Transport Pilot's. No rated school can give a course higher than that for which its rating calls.

Rated schools must be open to inspection by the Department of Commerce at any time, and must renew their certificate of rating every year.

The rating may be revoked if the school does not operate according to the rules laid down in this bulletin, or if it does not observe the provisions of the Air Commerce Act.

There are a number of advantages of this rating. First, schools want to be rated, and will improve their

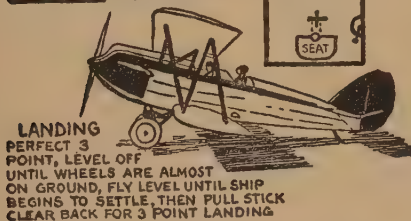
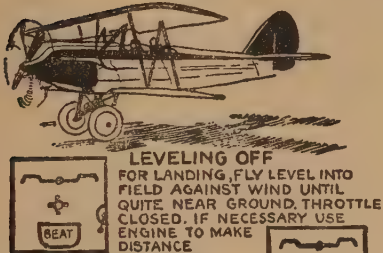
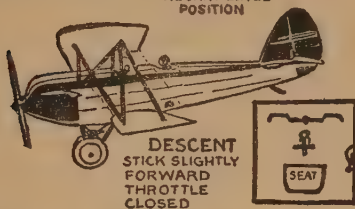
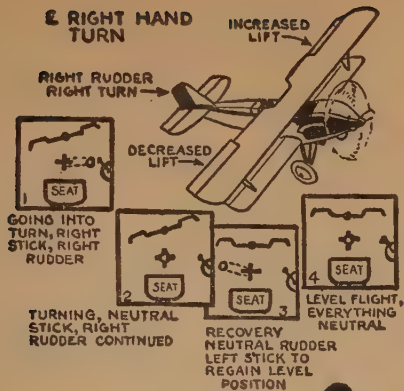
equipment and their course in order to secure a rating. Also, students who attend rated schools can be confident that they will be taught all they need to know in order to pass the various pilots' license examinations. They can be sure, too, that all the flying equipment of the school is maintained in first-class condition, because the Department of Commerce inspects the school regularly: and they can be certain of receiving organized and efficient instruction because the instructors are licensed.

Students at those schools rated by the Department of Commerce must complete whatever course they are taking within a certain specified time. The limits are four months for a Private Pilot's Course; six months for a Limited Commercial, and eighteen months for Transport Pilot's. Furthermore, the Department of Commerce has lowered the license requirements for graduates of Rated Flying Schools. Instead of demanding 10 hours of dual instruction and 10 hours of solo for the Private Pilot's license, a total of only 18 hours of dual instruction and solo flying is required; for the Limited Commercial, a *total* of 50 hours of flying, both dual and solo, is necessary, and for the Transport Pilot's license, a *total* of only 200 hours. Graduates of unrated schools, however, must have the 10

hours of dual instruction plus the *full number of solo hours*.

Owing to the various types of licenses issued by the Department of Commerce, Flying Schools offer different types of courses designed to fit men for the various kinds of flying. These courses fall roughly into four groups — Solo Course, Private Pilots', Limited Commercial Pilots' and Transport Pilots' Courses.

1. Dual Instruction Course. This consists of 10 hours of Dual Instruction, and one hour of Solo Flying. The average student who has had no previous training should have the full 10 hours of instruction in the air before he solos or is permitted to fly alone, though occasionally students who have had some preliminary training learn to solo after as little as four hours of dual instruction.
2. Private Pilots' Course. After completing the ten hours of Dual Instruction, the Student is given ten hours of Solo Flying — the number of hours required by the Department of Commerce for a Private Pilot's License. This course must be completed within four months.
3. Limited Commercial Course. This leads to the



SHOWING THE POSITION OF THE CONTROL LEVERS AND
THE CONTROL SURFACES WHEN TAKING OFF,
FLYING LEVEL, IN A TURN, AND LANDING
Courtesy of Popular Mechanics Magazine

securing of a Department of Commerce Limited Commercial Pilot's License, and consists of 50 hours of dual instruction and solo flying. The time limit on this Course is six months.

4. Transport Pilots' Course. Two hundred hours of flying, dual and solo, constitute this course, upon completion of which the student is eligible for the Department of Commerce Transport Pilot's License Examination. The duration of the course cannot be over eighteen months.

As a knowledge of the principles of flight; of motor construction, overhaul, assembly and maintenance, carburetion and ignition systems, operation and repair; of aircraft design and construction; of aerology and meteorology, air navigation, and other aeronautical subjects is necessary in order to pass the various Department of Commerce Commercial Pilot's written examinations, most flying schools give a ground-school course as a part of the flying course. In this ground school the student receives classroom instruction in the theory of flight, meteorology, elementary navigation, etc.; he receives practical instruction, in field repair shops, in the maintenance and repair of motors and in the diagnosis and remedy of motor and aircraft

troubles. He is taught how to make motor adjustments, how to make minor repairs to damaged aircraft parts, how to adjust the alignment of planes, and so forth.

That is, before he completes his flying course, he has a thorough understanding not only of how to pilot his plane, but also of the plane itself, its motor, and what makes the plane fly. Because the lives of his passengers are in his hands, the pilot, by eye and ear or by "feel," must be able to detect trouble at its inception, so that he can direct the field crew or even make his own adjustments.

He must also be able to read the signs of approaching storms; to tell when a storm is approaching which he cannot go around or over. Therefore, the ground school work is extremely important. Without a thorough knowledge of these things, a student cannot obtain a commercial license, cannot make flying a profession that will yield him an income.

The importance of this pre-flight, or ground school, education cannot be emphasized too strongly. It is essential to any pilot — in fact, to anyone who intends to engage in any of the many branches of the Aviation Industry, from the "Grease-Monkey" to the President of the Manufacturing Concern or the General Manager of the Transport Company.

Our Military Flying Schools require an extensive pre-flight education. The Department of Commerce requires a specified amount of ground school work, and insists that the applicant for a pilot's license pass a written examination on ground school subjects.

There are only three ways of securing this preliminary training. They are:

1. By the slow and tedious method of gaining practical experience as an apprentice. The apprenticeship method of trade education is wasteful and slow; under it, a great deal of time is lost and the apprentice works for very low wages. It requires years as an apprentice to learn what can be taught, in a few months, by one of the other two methods of training.

So inefficient is this apprenticeship system that it has been discarded by almost every vocation except a few classed as "skilled labor". And even trades like bricklaying and carpentry may be learned now, in a comparatively short time, at a trade school where text books explain what was formerly learned "on the job."

2. By attending a resident ground school, where the theory is studied at home and where class-room

periods are devoted to recitation, discussion or practical application of the theory.

This method necessitates the student's devoting considerable time to school attendance. That is, the student usually must give up his work and devote his whole time to attending classes during the large part of the day, and to studying at night. Not only does he sacrifice his earning power temporarily, but he must also bear such expenses as tuition fees, board and room, and so on.

3. By taking a home-study course on the ground-work in Aviation. Schools and Institutes offering Home-Study Courses in the Science of Aviation cannot be rated as yet by the Department of Commerce. This is because the Department of Commerce regulations are designed to cover residence Ground and Flying Schools only, where the student is in daily class-room or field attendance. The home-study school does not operate, naturally, on the same basis as the residence school; therefore, the regulations designed to cover residence schools do not fit the home-study school.

Eventually, however, the Flying School Regula-

tions of the Department of Commerce may be changed to embrace both residence and correspondence schools.

As there is no organization or council, in this country, qualified or authorized to rate Home-Study Courses in Aviation, the student who contemplates taking such a course must decide upon the merits of these courses for himself. He should investigate the reputation of each school and of the man at its head; should scrutinize the subjects covered by the course. He should make certain that the man who designed the course, and who is at the head of the school, is one who has an extensive knowledge of both the theory and practice of Aviation.

Home-Study Courses cannot teach you to fly. But they can teach you the subjects covered in the written examinations for Pilots of the Department of Commerce. And, in many cases, the Home-Study Courses cover these subjects much more thoroughly than the average ground school branch of the flying school.

Now that the Department of Commerce is rating residence ground schools as well as Flying

Schools, there will be some improvement in ground school instruction in general.

Commercial flying schools are located in every state in the Union. They have been established at almost every airport, municipal or private. Some have built their own landing field; others are using fields that have been developed by aircraft manufacturers in connection with their factories. For the purpose of securing definite information on this subject, I sent a questionnaire to 138 of the leading schools, a mere fraction of the number actually in existence and actively engaged in training and building up the flying personnel which Aviation needs so badly. From these questionnaires, I learned that in towns, hamlets and cities from Aroostook to San Bernardino, and from Jacksonville to Seattle, licensed pilots (some of them war or pre-war flyers, others the product of post-war schools) are busily engaged in teaching men and women to fly. There is no town in this country whose air-minded citizens do not have within comparatively easy reach, a flying school at which they can carry out their ambitions to become flyers.

You have had the answers now to the questions, "Can I learn to fly? How can I learn to fly? And where?"

The time necessary to learn to fly is fairly well established by the Department of Commerce rating — a maximum of four months being allowed for completion of the Private Pilot's Course, of six months for the Limited Commercial, and of eighteen months for the Transport Pilot's Course. It is possible, given good flying weather, to complete any of these courses in much less time than the maximum allowed by the Department of Commerce.

In the year 1928, there were only 1062 airplane accidents * in the United States. Of these, 755 resulted in no injury to either pilot or passenger. In only 307 accidents were people killed or injured. These figures include the U. S. Army, Navy and Marine Corps flying schools and all Air Transport flying, and all flying schools, both rated and unrated, as well as Commercial Express and Air Mail flying. Three hundred and seven accidents of any consequence in over 69,888,307 miles of flight; in 650,000 hours of flying by thousands of men! Fewer accidents in a year for the whole country than there are automobile accidents yearly *in one city* like Washington, D. C., in the same period of time,

* These figures are taken from the Aircraft Year Book for 1929, and from Bulletin No. 13 of the Department of Commerce, Aeronautics Branch.

where there were 5,632 automobile accidents in 1928, in which 3,039 people were killed or injured! Less than one accident a year to each of 2512 passengers! (and the big majority of those resulting in only slight injury to the occupants of the plane).

The airplane is safe, its design has been perfected, and motors improved to such an extent that one of our Commercial Air Transport Companies had *no* accidents in over 500,000 miles of flying. Airports and landing fields are larger, smoother and better equipped than they were a year ago. In 1929, in spite of the greatly increased number of flying schools and people learning to fly, accidents will probably be fewer than in 1928.

You are as safe in an airplane as you are in your bed. In fact, I often wish, as I walk along some busy street or drive my car along a highway, that I was up in the sky, flying my plane up there where there is no heavy traffic, where one has only oneself and one's plane to look out for. Up there, I feel safer by far than I do on the ground.

And that is no idle fancy. In the many years of my association with Aviation, I have seen tremendous strides in the design and construction of planes; I have seen the introduction of safety devices on the plane it-

self; of improvements in motors and aircraft that make the modern plane safer, more stable, than once we dreamed they could be made. In any of the standard planes made under approved type certificates, I feel perfectly at home, perfectly safe — confident that the plane, with proper handling, will take me where I want to go quickly, comfortably and safely.

Now I want to put down a few of my own ideas about the selection of a flying school. I have lived close to Aviation for years; I know Aviators and Aviation people; I know planes; I know methods of instructing the student to fly. I have been both a student and an instructor in the Naval Air Service, at Pensacola and Rockaway. I've tried out different methods of training and have studied the different kinds of schools. As a result of my study, I have come to the conclusion that the flying school should be chosen in much the same way that a college or university is selected. That is, there is more to be considered in the choice of a flying school than the cost of the course alone. You can learn to fly for as little as \$200. You can learn to fly at almost any school or airport where there is a plane. Just as you can get an A. B. degree at any accredited college which gives a four-year academic course.

In selecting a school, — whether it be a flying school

or a college, — you should keep an eye to the future. Remember that learning to fly is not the only thing that must be learned about Aviation. You can learn a great many things at a flying school in addition to the piloting of a plane. Remember that you can get a great deal more from one instructor or method of instruction than you might from another; that you can learn much by discussing your problems with other students; that you can gather valuable information by talking to aviators who come to the flying field. And, above all, remember that the contacts you make in flying school will have a great deal to do with your success in after life. The man who goes to a small, unrecognized school may have quite a struggle before he reaches success; the man who goes to a good school makes contacts at the school and at the field which may mean almost immediate success. He acquires polish by rubbing elbows with other students — men from all parts of the country and from all classes of society. He becomes broadened because of his association with them. And he acquires more information and more ideas because he gets a wider range of views and opinions than he would at a small school.

Summing up: at the better school the student acquires polish and breadth of view and he makes valuable friends while obtaining the desired training. That

is as much a part of his flying school course, of his preparation for his life's work, as the studying of the actual curriculum itself. He may make an impression on some man who stands high in Aviation and who will give him a boost up the ladder to success. And he will, upon graduation, have a recognized school back of him; a school to which he can be proud to refer, and of which those people to whom he applies for a position, know. He will be well on his way toward attaining one of the many opportunities in the flying game which are outlined in the next chapter.

CHAPTER THREE

Flying Jobs in Aviation

IN 1903, the crash and destruction of Langley's "flying machine" made him the laughing stock of thousands. The whole world nodded solemnly and agreed that man was not meant to fly.

Three months later, on December 17, 1903, Orville and Wilbur Wright, two bicycle repair men from Dayton, Ohio, accomplished the first flight, at Kitty Hawk, N. C., in which a heavier than air flying machine carrying its operator, rose from the ground under its own power and flew in sustained free flight.

This was the birth of flying and of Aviation as it is known today.

During the following years the unbelievable was accomplished. One would hardly have considered the morning paper complete if announcement of some new airplane record had not been made. A succession of epochal flights followed across the Atlantic — to France, Germany, Spain and Great Britain; around the world; from California's coast to Australia; across

the Pacific to Hawaii; from New York to Los Angeles, — the interest of America's youth has focused upon Aviation, and particularly upon flying, as a profession.

Only a few years ago every boy, from the tot who could just lisp his name to the youngster in High School, wanted to be a Lindbergh. While every boy still dreams of winging his way alone, across some unspanned waste, winning glory and renown, his dreams take on a more practical hue as he grows older. As he earns his first dollars, he begins to visualize some of the practical problems which will face him in later years when he must make his own way. And he begins to consider, seriously, the possibilities of flying as a means of livelihood.

Not long ago, a young man dropped into my office for some advice on this subject.

"Mr. Hinton," he said, "my father wants me to be a lawyer, but I want to learn to fly. Can you tell me what to do?"

While that sounded like pretty much of a problem, I thought his case over for a few minutes, and decided that there were a number of questions which he would have to consider very carefully, and answer for himself. That is, I decided to give him my ideas of the problems confronting him, and then let him make his own deci-

sion. As these questions are very similar to those that confront the average man who wishes to be a pilot, I am going to present them here as I presented them to my young friend. And I am going to give their solution based on my own experience and the experience of hundreds of others. After considering the various factors involved, I am confident that the average man will arrive at the same decision reached by my young friend, who came back to my office a few days later and announced that he had decided to become a pilot.

Here are the questions:

- (1) What does flight instruction cost?
- (2) How long does it take to get a pilot's license?
- (3) How large a salary does a licensed pilot command?
- (4) How do the answers to the three preceding questions compare with other professions?
- (5) How many different kinds of work are open to the licensed pilot? How are these positions found?

Before going into these problems, I want to stress again, that Aviation is already a big industry, and that it is growing rapidly. Because of its size, it offers employment not only to the flyer but also to the youth just

out of high school who is ready to serve an apprenticeship in preparation for his life's work; to the college or university man who has equipped himself with a general education or specialized training in engineering, law or many of the other professions, and to the man who has had practical experience in any one of a great many trades, vocations and professions as well.

Aviation needs both ground-workers and flyers. It needs engineers and designers; sales, advertising, accounting, engineering and financial executives; purchasing agents; production men and factory superintendents; factory foremen; specialty salesmen and publicity men; office workers of every description, and both skilled and unskilled factory and flying-field labor.

All of these opportunities "on the ground" I have treated in a later chapter. Here I am concerned only with those positions that have to do with flying; here, I am discussing only "opportunities in the air."

Aviation needs men who can fly. It needs them in many strictly flying jobs, such as piloting transport planes and "air taxis"; factory test flying; mail and express piloting; delivering planes to dealers and to sales departments; instructing at flying schools; "pleasure-hopping" and sightseeing; aerial mapping and surveying; crop-dusting, planting, and so on.

But the field for flying men is much wider than that. Business is turning to the plane, equipping executives and salesmen with airplanes; using planes for the delivery of rush orders of parts and supplies. In fact, new uses for airplanes are being developed so rapidly that a list that is complete today represents only a fraction of the airplane's uses six months hence. And as refinements in design of both plane and engine improve airplane performance and reliability, sales of planes will be increased, prices of aircraft will be reduced, and new uses for the airplane will be developed more rapidly than ever.

This means an ever widening market for airplanes, and an equally increasing demand for men who can fly, from the private to the transport pilot.

Business men, salesmen and executives, therefore, who use their planes for business or for pleasure may pilot their own planes provided they hold a private pilot's license. By using an airplane, a salesman can cover a much larger territory more frequently and, at the same time, cut down the amount of time he spends in non-productive travel. It is estimated that a salesman, on the road, spends twenty percent of his time actually traveling, and has, therefore, only thirty per-

cent to devote to obtaining interviews and selling. The executive can visit branch offices more easily and with less loss of time; the business man can make quick trips to the market centers, to expositions and factory centers.

To all of these men, the ability to pilot a plane offers increased earning power. And it offers, also, new fields of endeavor; new markets; advantages over less air-minded competitors. It offers to salesmen and executives a new group of employers — firms in the Aircraft Industry and its contributing industries.

A private pilot's license can be secured in a number of ways and at a small cost. Later on, I will give tables showing the costs of securing this license, as well as other licenses.

Under the present Department of Commerce regulations, a private pilot cannot fly for hire, nor may he transport passengers. But he can fly his own or another's plane, within certain limits, on business or for pleasure, provided he is not actually paid for flying.

However, the first license that enables the holder to receive pay for actual flying is the Limited Commercial license. Therefore, I am going into greater detail about it, than in describing the private pilot's license.

Now, to get back to my friend and his problem. Because he wanted to make flying itself his profession, we decided that he should disregard the Private Pilot's Course and concentrate instead on the Limited Commercial.

At first glance, the cost of securing this license and the length of time required to prepare for it seemed to dampen his ardor. But a comparison of the cost of this training with the cost of preparation for *any other* profession rekindled his enthusiasm for flying. To become eligible for a limited commercial license, the flyer must have 50 hours of solo flying or, if he attends an "approved" flying school, he must have completed successfully a course of ground instruction and 50 hours of flying, including not less than 25 hours solo flying time and not more than 25 hours dual instruction.

The average cost of securing this training, both ground and flying, is about one thousand dollars. In the New England and Middle Atlantic States, the cost is a little higher, while in the Middle and Far West some reputable schools offer a Limited Commercial Course for as little as \$675.00. This sum can be paid either cash in advance, or on a time-payment basis as the flying instruction is obtained.

Given good flying weather, the average student pilot can complete both the preliminary ground school work and the flying training in approximately three months' time. Living expenses during this period should not average over \$15.00 a week. To the \$1000.00 average cost of instruction, then, we must add \$180 for living expenses, making a total cost of \$1180.

That may seem like a lot of money. It *is* quite a bit, of course, to the average man. But, compared with the cost of training for any other profession, it is small.

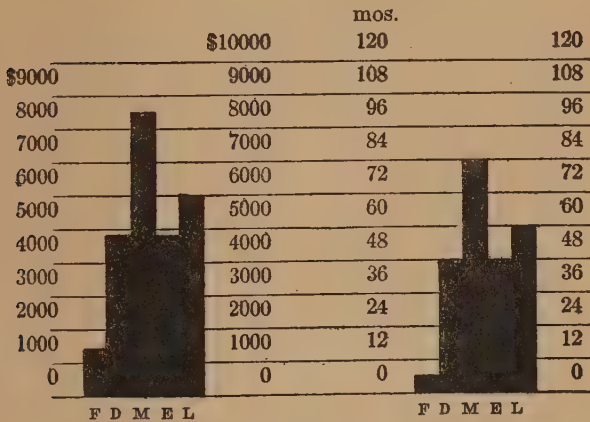
Take law, for example. Ordinarily, it takes two years of college and three years of law school before the embryo lawyer is ready to take his bar examinations and to start active practice. According to the United States Bureau of Education, it costs about \$1200 for each year of college or professional school,— this figure including, of course, both tuition and living expenses. At this rate, it costs \$6000 to become a lawyer, compared with \$1180 for a limited commercial pilot.

The table below compares the cost of a flying education with the cost of professional training. It shows, too, the relatively short time necessary for the preparation for a flying career as compared to the other professions.

Comparative Costs of and Time Required for Professional Training

Occupation	Months	Times as long	Total Cost	Times as expensive
Flying	3 to 6	1	\$1180.00	1
Dentistry	48	16	4800.00	4.4
Medicine	84	28	8400.00	7.7
Engineering	48	16	4800.00	4.4
Law	60	20	6000.00	5.5

Graphic Comparison of Costs of and Time Required for Professional Training



E = Engineering

D = Dentistry

L = Law

F = Flying

M = Medicine

By this comparison, we learn that the training for the other professions costs from 4.4 to almost 8 times

as much as flying, and takes anywhere from 16 to 28 times as long to complete!

Then, too, we must remember that the flyer is out *earning money* for from three to seven years before any of his brothers following the other professions are ready to pass their "state board" examination! In that time, the flyer earns between \$10,000 and \$15,000, which makes the difference in cost of preparation for the other professions even more striking! It costs the flyer, then, much less to prepare for his training than it does men entering the other professions. The next question is,— "How large a salary does a licensed pilot receive? How does it compare with the other professions?"

First, let us consider the limited commercial pilot. While he is not allowed to carry passengers for hire, except in the limited areas mentioned in his license, he is permitted to transport freight and express, to deliver planes from manufacturer to dealer and from dealer to purchaser, and to act as co-pilot on large passenger transport planes. He may get a job as pilot for an aerial photographer; as crop-duster; aerial advertiser; "flying salesman," and so on. These jobs pay from \$175 to \$500 a month, depending largely on the individual's ability.

In my opinion, this compares very favorably with the

income earned in the other profession during the first few years after leaving school. The average young engineer earns, probably, between \$100 and \$150 a month during the first two to five years after graduating from engineering school. I have known plenty of young lawyers who considered themselves well paid if they got \$125 a month during their first year of active practice. Graduates of some of our best university business courses are told, in the senior year, that they will be lucky to get \$25 a week; and a great many of them actually make no more than that,—and some make less,—when they first start on their climb toward business success. Dentists and doctors usually must make a comparatively heavy investment in office equipment and supplies; and, as a rule, the first two or three years of their practice is pretty rough going. I should say that the doctor or dentist who clears \$150 a month above his office expenses — rent, interest on equipment, etc.,— does very well indeed.

As far as income is concerned, the limited commercial pilot fares better than his professional brothers, as his salary averages \$225 per month in his first year. Of course, I expect to hear a storm of protest from professional men to this effect: — “But the lawyer, doctor, dentist and engineer are just starting. Look at

their *future*. Look at the number of them who are making *very good* livings after five or ten years of practice and experience. What's the *first* year? That's just the start. It's the later years that count." All very true, I'll admit. But the limited commercial pilot is also building up a future — and making good money while he's doing it! Because, in his first year of flying, he is accumulating "hours in the air." And the more flying time he obtains, the greater becomes his potential income.

It requires fifty hours of solo flying to become a limited commercial pilot, and two hundred solo hours to become a transport pilot. These hours of flying do not have to be amassed at a flying school, however; they may be accumulated at work — in the service of an aerial transportation company, with any of the numerous "flying services," or in flying one's own plane. Therefore, the limited commercial pilot, in his first year of active professional flying, usually gains more than enough time "in the air" to qualify him for license as a transport pilot.

By taking the Department of Commerce examination, after he has 200 hours of solo flying to his credit, the pilot obtains his transport license. This license is divided into twelve classifications, as follows:

Class 1 — Experienced in piloting Planes weighing less than 3500 pounds.

Class 2 — Experienced on Planes weighing from 3500 to 7000 pounds.

Class 3 — Experienced on Planes weighing over 7000 pounds.

Each of these three divisions is again split up into the following subdivisions:

- (1) Experience on open cockpit Planes.
- (2) Experience on cabin Planes.
- (3) Experience on single-engined Planes.
- (4) Experience on multiple-engined Planes.

Two more divisions will probably be added, covering experience on seaplanes and landplanes.

Once he has secured one of these licenses, his earning power is practically unlimited. He is permitted to carry passengers. He can buy a plane and go into business for himself, carrying passengers on pleasure flights, or carrying express and passengers between cities. He may instruct at flying schools; he may carry passengers for one of the transport companies or taxi services; he may qualify as a test pilot at a factory or flying field or he may fly a mail route. In all of these jobs, he

receives usually a "base pay" of from two to five thousand a year, plus so much an hour or a mile for actual flying. Air mail pilots, for instance, will average around \$600 a month; some of the first and second pilots with the big air transport companies earn between ten and fourteen thousand dollars a year. Factory test pilots receive from six hundred to as much as fifteen hundred a month; instructors make from \$400 to \$800 a month, and so on. During the time the pilot is flying, if he is at all alert, he acquires valuable information along technical and business lines. That is, he learns how an air transport line is operated; or, by flying planes of different types, studying their performance, and noting improvements that could be made, and by studying aeronautical engineering, he may become qualified as a designer or engineer.

No longer are his activities limited to flying. Now, he is well fitted to step into an executive position, where salaries range from \$10,000 to \$50,000 a year or more. Or, perhaps, he is able to start his own air line, where earnings are unlimited.

So the future of the flyer compares favorably with that of any other professional man. Really, he is probably better off because his field is uncrowded. The average pay of all transport pilots in the United States in

1928 was \$465 a month. What was the average income of doctors, dentists and lawyers? Universities have been turning out doctors, dentists, lawyers and engineers for several generations, until the competition in these fields has become very keen; until the supply of trained men almost exceeds the need for them.

Not so with flying. A generation ago, Aviation was unborn. A handful of men were experimenting with crude airplanes,—and their efforts were scorned and ridiculed. In the past 25 years, Aviation has grown from a dubious experiment to a great industry; air transportation has developed into a great public utility.

The supply of men is far exceeded by the demand for men. And it will take many years for the supply of men and the demand for Aviation manpower to become evenly balanced.

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OPPORTUNITIES in the Air exist for those men, too, who do not wish to fly only, who are not paid for actual flying, but who use their flying ability in their business.

The executive of a firm with offices in Cleveland, Detroit and Indianapolis can answer his morning mail in Cleveland; be in Detroit for a ten o'clock conference;

lunch with a prospect in Indianapolis, and be back in Cleveland in the afternoon in time to sign the letters he dictated in the morning!

In another chapter of this book, I am outlining the uses for airplanes in business. Here it is sufficient to say that business men who learn to fly make themselves thereby more valuable to their business or their employer; that salesmen increase their earning power; that engineers open new fields of endeavor, and that other men in varied occupations render themselves more valuable to their employers by learning to fly.

Air Jobs for Non-Flyers

AVIATION offers opportunities "in the air" to a large number of men and women who have not the ability to fly. Business men and executives who fly to their branch offices frequently take their secretaries with them — either young men or women. By their willingness to fly, these people place themselves in line for promotion: not only because they probably will receive a higher salary *because* of their willingness to take to the air, but also because on these aerial trips they come into closer contact with "the boss" than they ever would at the home office, and they have a better opportunity

to study the traits and methods that have made him "the boss."

Air transport companies are now using larger planes. Planes are already being developed that will carry 50 or 100 passengers, and that will fly all night. "Diners" are already operated on some air lines. Some day we may have barber and beauty shops on the largest airliners!

The use of these airliners has created the need of flying stewards and stewardesses; of flying conductors and porters; chefs; waiters and so on. As the size of the liners increases, other types of workers will be needed for the "flying crew."

The growth of the air mail is creating a need for aerial mail clerks. The development of radio telephone and telegraph has created a demand for radio engineers and operators aboard the transport planes. Increasing use of aerial maps and pictures has opened a field for the photographer who is willing to fly and to apply himself to learning the principles of aerial photography.

Cross-country flying and the probable trans-ocean passenger service have created, and will increase, the demand for navigators, aerologists and meteorologists. Flying mechanics who can make adjustments and re-

pairs to aircraft engines while in flight will be in demand.

City engineers, city planners, city traffic engineers, tax assessors and other municipal officers are using airplanes and aerial surveying in the solution of the problems they face.

Geologists for oil companies are prospecting for oil-lands by airplane. Timberland is surveyed and the stand of timber is estimated from the air. Herds in the cattle and sheep sections are counted by men in airplanes.

It is conceivable that planes will be developed to such size that they will require electrical engineers to see that lighting, refrigerating and other mechanical and electrical equipment is kept in good running order.

In fact, the future of Aviation is so great that it challenges the imagination. No one can say what the limitations of Aviation will be; to what size airplanes will grow; to what uses they will be put, and over what distances they will operate.

We can only watch Aviation grow, helping its growth in every way we can; and, as new uses of the airplane are found or as old uses are enlarged, be on the alert for opportunities for ourselves, for openings for which our native capacities and our abilities and training will fit

us. Aviation, in its growth, will open the door of Success to men and women in almost every walk of life, if they are only awake to their opportunities and prepared to take advantage of them.

CHAPTER FOUR

Ground Jobs in Aviation

IT was the dynamic Napoleon Bonaparte who said, "An army travels on its stomach." If he had lived a hundred and twenty-five years longer, he would probably have said that "Airplanes fly with their feet on the ground."

Nothing could be truer. Airplanes are kept in the air, in flying service, only because of efficient ground organizations. Factories, airports, emergency landing fields, supply and repair stations and all of the efficient workers employed in these establishments make possible our present safe systems of air transportation.

Though operations would be cumbersome and costly, railroads could run without terminals, ships could sail without harbors. But no flying, either commercial or military, can be done unless there is a field from which airplanes can take off and on which they can land. Landing fields, or airports, are of vital importance, and must be supplied with the varied equipment necessary to the safe and continuous operation of aircraft.

So essential is a base of operations to any kind of flying work that almost every navy in the world has found it expedient to build airplane carriers, armies are constructing military air depots and cities, towns and hamlets are developing airports.

In a few short years floating airports of vast proportions, anchored permanently in the oceans, will link all continents. I firmly believe that when these floating landing fields are in daily service, and air transportation is in scheduled operation over the Atlantic and Pacific, it will be found that the trans-oceanic air service, in competition with steamships, will save more money for business than is saved by air transportation over land in competition with railroads. We often hear that several of the trans-Atlantic ocean-liners have made the trip from Europe to America in a little over four days. Those are wonderful records, but it must be remembered that the average speed of trans-Atlantic ship service is much slower, and that as yet, fast ships sail very infrequently from any one port.

On land, our railroad trains average about 40 miles per hour while airplanes average at least 100 miles per hour. Therefore it is evident that an airplane travels fully two and one-half times faster than our fast mail trains. Over the ocean, airplanes will show an

even greater contrast. The steamer that maintains an average speed of 20 miles an hour is a fast ship. Thus it is very easy to see that airplanes, utilizing floating landing fields (or seadromes), will speed up trans-oceanic travel by at least five hundred percent.

Airports occupy so fundamental a position in the aviation industry, and opportunities for men and women are so great at these airports, that I have devoted an entire chapter of this book to a discussion of the airport of today and tomorrow and of the employment possibilities for various types of workers at airports now and in the future.

Just as most people, in scanning Aviation for opportunities for their own advancement fail to consider the possibilities of working at an airport, so also do they fail to realize the vast army of people necessary to insure the efficient functioning of an air transportation company.

This lack of knowledge of the inner workings of an industry does not characterize the public attitude toward Aviation alone. Consider railroad organization, for example. The average person thinking of railroad employes, pictures only the engineer, fireman, conductor, brakeman and porter. He does not think of the thousands of men employed in roundhouses and repair

shops, on roadbed and bridge crews; maintenance of way, handling freight, baggage or express; for signaling, scheduling, and for the vast amount of accounting, engineering and other office work that is essential to the efficient operation of any great railroad system.

Actually, the "train crew" constitutes but a small part of railroad organization. It would be just as reasonable to say that only locomotive engineers can succeed in railroad work, as for example, it would be to say that no one but a pilot can succeed in the field of Aviation!

So many different opportunities are offered in air transportation, aside from flying jobs, that they, too, have been treated in a separate chapter. In it I have gone into considerable detail over the many types of executive and office personnel required to handle the work of an airline operator,— both flying and "ground."

It is true, of course, that today the pilot is "king." He can demand — and get — a salary that, when the Aviation Industry is fully developed, he may not be able to command. As that day is distant, it is not fair to belittle the really wonderful opportunity that good pilots have, and will have for some years to come, for drawing "Big Money." And "Big Money" it may be considered.

In the year 1928, the *average pay* of all licensed transport pilots was \$463.51 per month. There are few professions — probably none — that can show as good an average income as that.

But there are even greater opportunities "on the ground." In the first place, piloting is becoming simpler as instruments to aid in the controlling of airplanes are developed. The Radio Directional Beacon and the Echo Altimeter, for example, have each taken some of the risk out of flying, and have made the pilot's work easier. Again, at least forty men are required in ground jobs to keep one airplane in the air and other men are needed to direct the work of these ground-men. Then, too, the requirements for airplanes are increasingly difficult to meet. Greater safety, higher speed, easier controllability, greater stability, lower landing speed — these require perfection of design, development of safety devices. And they mean work for the designing engineer.

One indication of the fact that the opportunities "on the ground" are really greater than those in the air is that many former pilots are now in executive positions with aircraft and airplane product manufacturers or aerial service companies. Flying is merely incidental to their positions. For the man who is not interested in

flying it is obvious that the Aviation Industry offers a new and rapidly expanding field of opportunity.

Aircraft manufacturing has been increasing for several years past, at the rate of from one hundred to two hundred percent per year. During 1928, nearly five thousand airplanes were manufactured in this country alone. In 1929, it is estimated that between ten and fifteen thousand planes will be built. And there is every indication that the production of new aircraft each year will continue to increase at this rate.

Figuring that forty men are needed in ground jobs to produce and service one airplane, it is probable that, in 1928, there were 200,000 men engaged in the Aviation Industry in one sort of work or another and that this number will increase enormously as aircraft production increases.

Any man, therefore, who is willing to fortify his ambition with training or education along aeronautical lines, can win rapid advancement and rich rewards in one of the many ground jobs in Aviation.

Before selecting a vocation, before entering *any* field of endeavor, every man should look very carefully into the future of the industry he is about to enter. He should not let his better judgment be clouded by con-

ditions that may be favorable today, but doomed to change tomorrow.

Aviation stands the test of analysis. History has proved, time and time again, that man will adopt any better and speedier means of transportation no matter what the cost of scrapping the slower method, well knowing that the saving in time effected by the more rapid form will more than repay the expense involved in its adoption. In addition to its speed, another feature favorable to the adoption (and continued growth and development) of Aviation is that the installation of Air Transportaion Lines is relatively cheap and can be accomplished quickly. It takes years to build five thousand miles of railroad; but fourteen thousand miles of airlines were added to those already established in the first six months of 1929!

While the United States and a number of European countries are well covered by a network of railway systems, there are many other countries in which railroad development is practically negligible. In such countries, airplanes will be used for transportation because air lines can be put into operation with a much smaller investment and in much less time than railroads or even highways. These countries — India, China, South America, Australia, Canada and many others —

will offer an almost unlimited market for airplanes and airplane products over an indefinitely long period of time.

All of this assures any thinking man that Aviation is here to stay; that it is as stable as any of our great basic industries and that opportunities in it are greater because of its very newness.

An example of the importance of analyzing the Industry you seek to enter is offered by an incident that occurred in my own office. But first let me say, that self-analysis is almost as important as opportunity analysis. Many a good man never finds the chance to prove his worth because he fails to study himself, to pick out the phases of his ability and experience which should make him valuable to a particular industry and to a certain group of employers in that industry; and, even if he *does* analyze himself, he is *afraid* to sell himself to an employer. He hasn't the nerve to go out and use all the sales ability he possesses to create the desire, in a prospective employer, for his services. And now for the story illustrating the importance of analysis applied to the job:

A sober and substantial appearing young man came into my office and asked me to help him find employment of some sort in Aviation.

During my conversation with him, I learned that he had a good engineering education; that he had grown up in the paint business; had learned to fly in the Army Air Corps. After the War, he had gone to work for a paint manufacturer. Soon he was specializing in the sale of aircraft finishes; then he started to cover his territory by airplane. Next, he acted not only as salesman but as technical advisor to manufacturers on their aircraft finishing problems. He designed color-schemes and formulated finishes.

Then his firm was bought out by a company that was not interested in the aircraft-finish business. He was now out of a job. So he bought two planes and started to operate a flying field of his own. Because of lack of sufficient capital, he was not entirely successful in this field.

He had reached a point where he had to look to the future. He did not want to fly for a living for the rest of his life, nor did he want to start in as a salesman of house-paints. He simply didn't know which way to turn.

And yet he had had experience which might be of inestimable value to some firm. He could sell; he could fly; he knew paints, lacquers, varnish and dope from

A to Z. Surely some firm would be glad to obtain his services.

We selected one or two companies which were starting to push their aircraft finishing departments. We gave him their names and addresses. We advised him what points of his experience to stress. And we impressed upon him the fact that he was doing his prospective employer as much of a favor in offering his services as the employer would do him by taking him on. A few days later, he came back to my office, his face glowing.

"Everything's all set!" he exclaimed. "I saw the Big Boy himself — talked to him just as you told me to. And say, do you know he was just as glad to get hold of me as you said he'd be?"

"Yes?"

"Sure! I just told him what I could do, and he took me on."

Because he sold himself well, that young man got a good job managing the middle-western territory of one of the biggest firms in its line in this or any other country. He *analyzed* himself, one might say, and then went out and *sold* himself.

You who are looking for advancement, and who are turning to Aviation for your opportunity, should ana-

lyze Aviation. Figure out the many kinds of jobs in Aviation. Analyze yourself. Decide what particular niche you can fill better than someone without your qualifications. Then — find a reliable firm engaged in Aviation which has that job to offer, and sell your services to that firm. Somewhere in Aviation there is a place for you. The only way you will find it — unless you tumble into it through blind luck — is by studying Aviation and yourself.

Perhaps you will fit into the organization of an air transport line; it may be that you belong in airport work. Or your future may be along manufacturing or educational lines.

As separate chapters have been devoted to opportunities with airlines and airports, let us here discuss only the latter two fields — manufacturing and educational work.

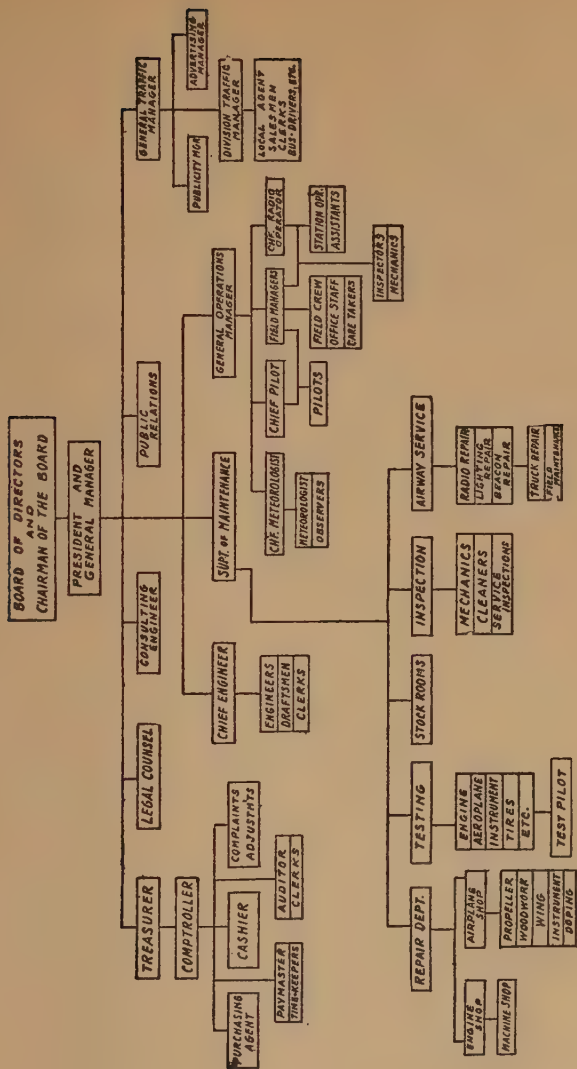
Aircraft Manufacturing

A FEW years ago, airplane manufacturing was carried on (except in a few notable exceptions) in a rather hit-or-miss fashion. A group of men would come together, get up a set of drawings, assemble various kinds of materials and start to build a plane. None of them

knew much about it, none of them specialized in any one branch of aeronautics. The whole group worked together on every part of the plane — some of them working only in their spare time. As a rule, it took weeks and even months to build a plane; and, when it was finished, whether it would fly or not was problematical. Today all that has changed. Airplanes are manufactured by mass production methods in modern factory buildings, covering acres of ground, and equipped with all the latest production machinery. An output of one plane a day is not uncommon. Some manufacturers are working on a schedule of three planes a day while at least one firm has laid out and equipped its plant for the construction of ten airplanes every twenty-four hours.

In building up an organization, the aircraft manufacturer has borrowed from the experience of the automobile factory just as he has borrowed ideas for plant-construction, layout and equipment. Because both the manufacturing and marketing problems of the airplane producer are similar to those of the automobile manufacturer, this "borrowing" has been possible; and it has saved the aircraft manufacturer a great deal of time and money.

In analyzing the organization of the modern air-



craft manufacturer, let us consider a large firm. Small producers may not have the same number of men employed but they still have the same functions to perform and probably combine in one man the duties which, in the large organization, are allotted to several men. For example, in a small company the treasurer may also act as secretary, purchasing agent and paymaster: or the chief engineer may also be production manager.

No matter what the size of the organization may be, however, its problems are the same. That is, any aircraft manufacturer, large or small, must produce the best possible plane for the least money, in the shortest possible time and must find a market for all the planes it can produce efficiently.

While many successful aircraft factories have been started by ex-pilots, it is not essential that the head of an airplane factory be a flyer. He must, however, know what type of plane he can produce and what the market for it will be. He must surround himself with men who know thoroughly the various phases of aircraft manufacturing, and he must have a pilot in his employ who can fly his plane,— test it and demonstrate it, develop its market and sell it to other flyers.

The Board of Directors consists of a group of able business men who have invested in the organization and

have the business ability and foresight to guide its destinies. They may or may not be thoroughly familiar with all the details of Aviation work; but they must know business in general, manufacturing and marketing problems and they must be convinced of the successful future of Aviation.

The President. As chief executive of the organization, this man must be a seasoned business man, thoroughly experienced in sales, finance and production and in the problems of building and holding together an organization. He must have keen judgment and a well-balanced mind. He must be able to co-ordinate the efforts of all the various men under him and direct their work to the greatest advantage of the entire organization. A thorough knowledge of Aviation would be of inestimable value to the President; but, if he lacks this, he should have one man at least who knows all phases of Aviation and who can speak with authority on the subject. The Aircraft firm whose President knows nothing of Aviation, but is a good business man is better equipped than one whose President is a good pilot but knows nothing of business. Fundamentally, aircraft manufacture is very much like the manufacturing of any other product. It is governed by the same economic laws and business principles as the man-

ufacture of shoes or golf clubs or automobiles. Therefore, the good business man would see the need of employing specialists in various lines; while the pilot would be apt to surround himself with other pilots who, perhaps, know even less about manufacturing and business than he.

The General Manager. Reporting directly to the president is the General Manager. Often this executive is Vice President as well. He should be a man experienced in operating a business and have the ability to see that the policy of the company and the directions of the President are carried out. Each major department head should report direct to him. The General Manager is responsible for the efficient and economical operation of the business and therefore he must be able to lead and direct others.

The remuneration of such a man is of course dependent upon his ability and experience and the magnitude of the operations he directs. In this position a broad knowledge of Aviation is highly desirable as well as a knowledge of mechanics and experience in sales and finance. While he need not be a specialist in any one of these lines, he should have a knowledge of the principles underlying the operation of each depart-

ment he directs as well as its relation to the other departments of the business.

The Treasurer. Under the direction of the Treasurer of the company, who reports to the General Manager, are all the various accounting and record keeping departments. These include the Cost Accounting Division, in which are a group of bookkeepers and clerks under the direct supervision of a cost accountant. In this department figures are prepared showing the various operating costs — production, sales, overhead.

Another division is the Capital Stock Records, in which all sales or transfers of stock and payment of dividends are recorded.

The Treasurer must also prepare all tax returns, and budget expenditures for the coming months.

Under the Treasurer is the paymaster, who directs the work of the timekeepers and payroll clerks. The paymaster must see that a correct record is kept of the number of working-hours of each employe, and must prepare and distribute the payroll — a considerable undertaking in a plant employing a large number of people.

As buying involves the expenditure of money, purchasing also comes under the direction of the Treasurer.

And the Credit or Collections Department, too, is under his control.

It is necessary that the Treasurer report to the General Manager because he (the General Manager) must always be conversant with the financial condition of the company in order to be able to direct all the various other departments and functions — purchasing, credit, production, sales, advertising and engineering.

The Chief Engineer. The Engineering Department, headed by the Chief Engineer, is next in line. The Chief Engineer must be a man qualified to supervise the development and design of aircraft and other products being manufactured. He must originate new models and improvements to keep abreast with the mechanical developments of the industry and must be a trained and experienced aeronautics engineer. The Chief Engineer is assisted by other aeronautical and production engineers, but upon him rests the full responsibility for the proper design, performance, production and testing of the product being manufactured.

His department is usually divided into sections. There is an engineer in charge of design and another in charge of drafting. Under the latter are many draftsmen, tracers, checkers and detail men. There is generally an engineer in charge of experimentation and

testing. His duties are to test the raw material before it is manufactured to see that it is made and furnished in accordance with specifications, so that production will not be started on defective material.

Under this department comes the testing of new ideas and devices, the employment of which might be contemplated in the production plant. In the case of aircraft and aircraft engine manufacture, this department also directs the testing and inspecting of all finished products.

The Factory Manager. In some organizations, this position is under the Chief Engineer. In others, the Factory Manager reports direct to the General Manager. In either case, the duties of this man are very important. On the shoulders of the Factory Manager rests, to a large degree, the success of the organization. Under him are all the manufacturing divisions of the company. To him the various shop superintendents and foremen report. He supervises the work of each of the various shop departments of the factory and co-ordinates the work of all of them.

He is a production engineer, planning methods of manufacture and putting into effect the manufacturing procedure. He schedules and routes work through all

the departments and sees that the schedule is maintained.

The Factory Manager must know thoroughly every process which enters into the making of the finished airplane: — layout of sheet-metal parts, tool-making, operation of all sorts of machine tools, welding, rigging, assembling, covering and doping and installation of instruments and controls. He must keep abreast of all new methods of manufacture and must devise cost-reducing short-cuts on his own account.

In other words, it is the duty of the Factory Manager to see that the manufacturing organization operates efficiently and smoothly, at the lowest possible cost, so that his company can meet the competition of other aircraft manufacturers.

In the factory proper, a great many different types of men are employed. As aircraft work is highly specialized, it is most efficient to split the factory into a number of departments each one of which handles a specific manufacturing process. At the head of each department is a foreman who is not only an expert in his line, but is an executive of no mean importance. In large organizations, the foreman may have one or more assistants — a “gang-boss”, a tool-setter and a time or production clerk.

The "gang boss" supervises the men in the department and is in charge in the absence of the foreman. The tool-setter aligns tools and dies, jigs and fixtures for the workmen. The time or production clerk sees that the production schedule is followed and that workmen have the necessary tools, materials and instructions before they start on any job. He also dispatches material in process (when his department has completed the operation it performs) to the next department. As the shop foremen of the future are drawn from the ranks of today's workmen, it is highly desirable that the many types of men employed in the various shop departments have a grounding in the principles of Aviation. Also, this knowledge will give the workman a greater interest in his job.

The Aviation Industry is expanding so rapidly that a great many young men who are now employed as factory hands will, within a few short years, fill better positions with all attending advantages if they will only combine study and preparation with their natural abilities for the job ahead.

The Aviation Industry has advanced in production far beyond the available supply of trained employes; consequently it is raiding other industries for the men it must have.

Men who are experienced in other lines of work can find opportunity in well paid positions in an aircraft factory. Let us consider a few of the general types of employes that are required in a factory in order to show what kind of workers are needed. Most aircraft today are constructed to a large extent of metal. While wood is still being used in wing construction, almost without exception, airplanes have metal fuselages. These fuselages are as a rule made of steel tubing put together by a careful welding operation. Therefore, high-grade welders are in demand.

Woodworkers are required to fashion ribs, spars and interior trim and to apply veneer wing covering on some types of planes. *Machine Tool Operators* are required to make fittings. *Copper Smiths* and *Tinners* are required to manufacture cowlings and special metal parts. In those planes that are made up of what are called structural shapes (that is, angle bars and T bars, etc.), *Riveters* and *Fabrication* men replace the welders.

Assemblymen are required to put on the component parts of an aircraft in the assembly line. These men are general mechanics and in the aeronautical industry they must be *skillful*.

Painters and *Finishers* find opportunities in the wing

doping and finishing departments of an aircraft factory. *Electricians* are needed to install the electrical wiring required in modern transport planes. *Upholsterers* are finding great opportunities because the interior of a modern airplane is upholstered and finished with fabrics in just as fine a manner as are the costliest of motor cars.

The United States Department of Commerce requires that all licensed airplanes be equipped with certain instruments. The operators of transport planes and air lines generally require their planes to be equipped with still more instruments.

These devices must be properly installed, as upon their correct functioning depends the successful operation of the aircraft. As in many instances these instruments are very expensive, their installation and care cannot be entrusted to ordinary mechanics.

This field of endeavor, the installation and testing of aircraft instruments, offers unusual opportunities to watchmakers and men who have had experience in making all kinds of instruments.

The great majority of aircraft today are covered with fabric. This fabric must be very carefully fastened upon the framework. As many women are well qualified to do this work, a great many are employed in the

Aviation Industry in the fabric department. Here large bolts of material are cut into proper shapes by the use of tested patterns. The various parts are then sewed together and sent to the Wing Covering Department where the fabric is stretched over the part of the framework for which it is designed. Later these parts are sent to the doping and finishing departments where the fabric is treated with what is called airplane "dope." This shrinks the fabric taut over the framework and fills the pores of the cloth, making it practically air tight. The fabric dope is applied prior to any decorative finishes that the manufacturer may care to put on his plane.

The Sales Manager. The sales department of an aircraft factory is one that offers wonderful opportunities to men who have had experience in directing the sales of other mechanical products, or to men who have combined sales experience with a knowledge of aeronautics and the ability to fly a plane.

It must be remembered that the Aviation Industry is undergoing a great period of expansion and development. It is a new industry and a great many of its operations are still in the experimental stage. No tried and proved sales methods have yet been established.

While the sales problems facing the manufacturer

of aircraft are, to a great extent, similar to those of the manufacturer of any other transportation device, the selling of aircraft is still a highly specialized and undeveloped field. Probably it can best be compared with the situation that confronted the automobile manufacturers during the first ten years of this century.

During that period few people knew how to operate an automobile. The dealer who sold a car soon found that it was incumbent upon him to teach the purchaser how to operate it. Obviously, no man wanted a car which he could not drive.

The same situation exists in Aviation. There are no doubt a great many persons who would purchase a plane if they were able to operate it safely. When a man decides to buy an automobile there is no doubt in his mind or in the mind of the salesman whether he can learn to drive the car. The purchaser's ability to learn is taken as a matter of course.

In ten to fifteen years the average man will be able to fly as a matter of course, just as he drives his motor car today. The chief obstacle now confronting the salesmen will then be eliminated.

There are a great many different types of aircraft being manufactured today and it can hardly be said that airplanes within any certain class are at all stand-

ardized. Two planes of almost identical appearance, and price may perform in totally different ways. Therefore, a great deal more demonstration work is required in order to sell airplanes now than will be required when the types of aircraft are more uniform and standardized.

New methods of finance for the retail purchases of planes must be evolved, opening vast opportunities for finance companies and banks. There is no reason why aircraft sales cannot be financed by the same methods as used for financing the purchase of other commodities.

Already several manufacturers of planes have evolved methods of financing sales that have been very beneficial to their business and have increased their sales volume considerably.

Great opportunities for the sale of American planes will be found also in foreign countries. In probably no other country in the world today can efficient planes be produced as rapidly or as cheaply as in the United States. Therefore an intelligent airplane factory sales manager will not lose sight of export business.

The Advertising Department. The advertising departments of aircraft factories are in a formative stage similar to that of the sales departments. This is demonstrated by the large variety of display advertise-

ments being used by aircraft manufacturers, and by the large variety of sales material that is being circulated.

It appears that no factory has yet developed a plan of advertising that is entirely satisfactory to its needs. The advertising man who will add to his professional ability a real knowledge of Aviation sales problems will find wonderful opportunities in the industry to build a very profitable agency business, or to secure a lucrative position as an advertising executive.

The Aircraft Sales Agent. In the majority of cases, at present, aircraft factories are selling their products direct. Methods of aircraft distribution have not yet advanced to the stage where factories have large dealer organizations. The aircraft sales agency offers wonderful opportunities to progressive and farseeing men to establish a well-paying and rapidly growing business. Automobile distributors who find their sales fields highly competitive will do well to investigate the fields open to them in selling airplanes. These businesses should be organized very much in the same way as are automobile agencies. Hangar and shop space can be established at most municipal fields from which the demonstrator machines may operate.

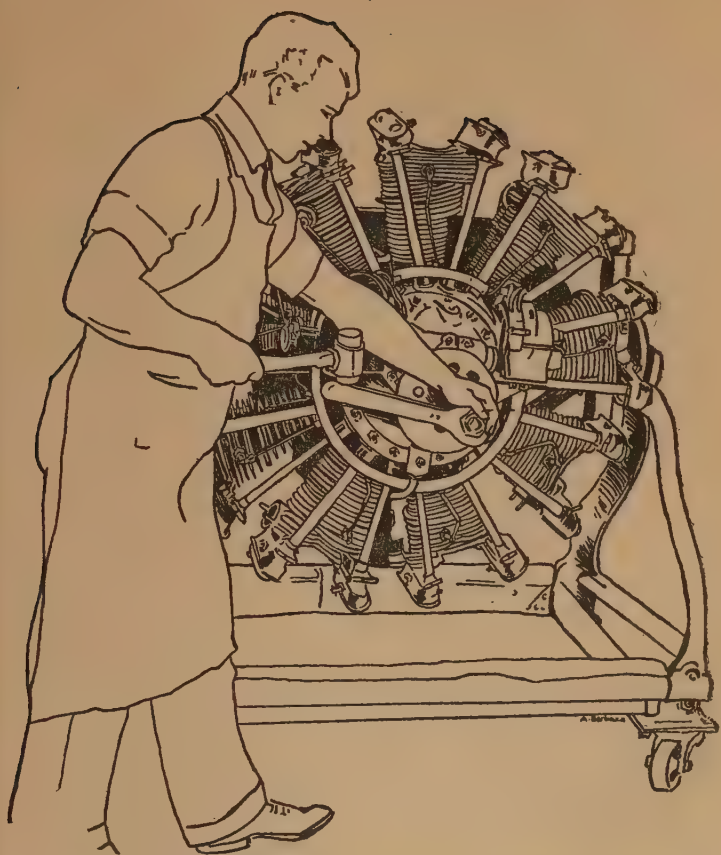
There is no question but that progressive sales

methods similar to those being used in the automobile industry will develop very profitable airplane sales agencies. The man who wishes to enter this business should maintain a dependable service department with its necessary complement of mechanics and also a parts department which carries in stock those parts of the plane which are most likely to need replacement.

Naturally the establishment of such businesses would create opportunities for the employment of pilots, salesmen, mechanics, stockmen, general office clerks and many others.

The opportunities I have mentioned are all with aircraft manufacturers. A great many more openings embracing the same and other lines of work are available with manufacturers producing aircraft supplies, accessories and instruments.

There are hundreds — yes, thousands — of jobs with firms who make the many products that are the “raw material” of the aircraft manufacturer. Many of these “contributory” concerns have been discussed in another chapter. Here, it will suffice to say that all sorts of machine-tool operators, factory timekeepers, production and despatch clerks, tracers, draftsmen, engineers and executives of all types can find, if they will analyze the situation, employment with opportunity for fu-



OVERHAULING A WRIGHT WHIRLWIND AIRCRAFT ENGINE

ture progress either in actual Aviation work or in some line that contributes to the development of aircraft and Aviation.

Aeronautical Education

BECAUSE the development of Aviation is positively dependent upon the production of trained men of all types and classes, the aeronautical education field is one that should be discussed, however briefly. Schools are required to train mechanics. While there are many schools throughout the country these are not graduating a large enough number of trained men. I really believe that too much stress has been put upon the training of pilots alone. No pilot can fly until some mechanic has made a plane for him, also he requires mechanics to maintain that plane in flying condition. Therefore, aeronautical trade schools that will qualify men to hold factory and flying positions should be profitable enterprises for those qualified to operate them.

This so-called ground instruction is a prime requisite for all of those who wish to enter the aeronautical industry. The Department of Commerce will not license a pilot until he has proved his knowledge of the funda-

mentals of Aviation. Neither will the Department of Commerce license an aircraft mechanic unless he has had a theoretical education. Therefore, the necessity for this type of instruction is apparent.

Public schools and colleges throughout the country are already including aeronautical courses in their curricula. The number of institutions doing this is extremely limited, however, and probably will be limited for some time to come. In addition to that, the time that a student must spend in a public school or university is many times greater than that required from a private training school. Thus it can be seen that for a good many years to come, private training schools will continue to render Aviation a great service and at the same time will do a profitable business.

Fundamentally these private Aviation training schools are business enterprises and as such they must be operated upon business principles. Each school must have its advertising and sales departments, student service and welfare department and its housing department. The man who knows this particular type of work or who can be trained to do it will be employed. This field is creating, and will continue to create, thousands of positions on the ground for both men and women.

The man or woman who devotes his life to the train-

ing of men for intelligent work in the Aviation Industry is contributing toward the solution of Aviation's greatest problem — the problem of securing efficient and sufficient manpower.

CHAPTER FIVE

Opportunities with Airline and Air Transport Companies

NEVER before, in the history of Aviation, have there been so many opportunities for employment with airline and air transport companies. Today, airlines are going into a period of expansion similar to the first growth of the railroads fifty years ago.

Hardly a day passes without the newspapers' chronicling some new airplane development or the expansion of air transportation. Forty-five transport companies, flying more than eighty thousand airplane miles daily, traverse the country from north to south and east to west over a network of airways rivalling the railroads. New lines are being added weekly, and new opportunities are being created daily.

The New York to Boston, Cleveland to Chicago, and Miami to Havana routes are so busy that a second airplane is sent out quite often because every available seat in the scheduled plane is taken. In the first six months of 1929, it is estimated that 8,000,000 miles

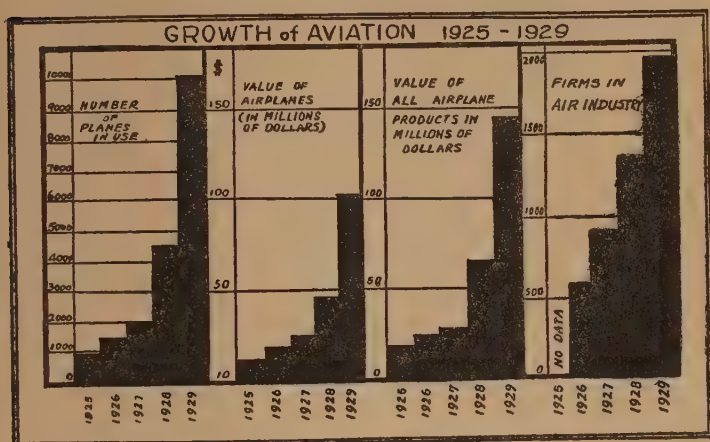
were flown on scheduled routes — almost as great a mileage as for the entire year of 1928. In this period, forty thousand passengers travelled in planes, as against 35,000 in all of 1928.

Cargoes of freight and express in 1928 totalled 1,800,000 pounds; in the first half of 1929, 1,200,000 pounds were carried. Air Mail poundage also increased, over 3,300,000 pounds being carried by mail planes in the first six months of 1929 as compared with four million pounds for the entire preceding year.

Because of this unprecedented growth not only in air transportation business, but also in the miles of airways in operation (nearly 15,000 miles of air lines were opened between January and July, 1929), the details of organization of air transport companies have not been fully perfected. The executives of these companies have been so busy trying to keep pace with the growth of their business that they have not had the opportunity to study as carefully as they might their personnel needs. They have been forced to add men, both to their flying and administrative organizations, as the need for these men arose.

Now, however, air transportation is on a firmly established basis. It has won its place in our transportation system. Traffic is being handled efficiently and smoothly,

and the chiefs of the transport companies are able to study their personnel problems, to determine the various kinds of work to be done and to decide on the types of men who will fit into these jobs.



Therefore, now is the opportune time to enter the field of air transportation, because the men — and women — selected now for the many positions in the air transport organization will have the chance to train themselves, or will be trained, for the higher positions which will inevitably be created as the use of airplanes by the public increases.

A table of air transport operations giving accurate figures for the years of 1926, 1927 and 1928 is given

below. Totals for 1929 are estimated, based upon such 1929 figures as are now obtainable. The figures giving the number of airplane miles flown are for transport operations only on regularly scheduled flights. Army,

<i>Air Transport</i>	1926	1927	1928	1929 estimated
Airplane Miles				
flown	4,318,087	5,870,489	9,888,307	22,000,000
Passengers	5,782	8,679	33,414	80,000
Express & Freight, lbs.	1,733,090	2,263,580	1,847,836	2,500,000
Mail carried, lbs..	810,855	1,654,165	4,061,210	7,000,000
Airplane miles scheduled daily..	11,830	16,083	27,091	80,000
Air Service (taxi schools, etc.)				
Airplane miles flown	18,746,640	30,000,000	60,000,000	100,000,000
Airports		902	1,224	2,500
Value of Airplanes & Aviation				
Products	\$17,694,905	\$21,161,853	\$64,662,491	\$148,700,000

The above information has been taken from the following sources:

- (1) Reports or estimates of eighteen Air Transport Operators.
- (2) Reports from 32 out of 41 operators to whom questionnaires were sent.
- (3) From the Air Commerce Bulletin, Vol. I, Number 3, for August, 1929. This bulletin is issued by the Department of Commerce, Aeronautics Branch.

Navy and Marine Corps, air taxi, pleasure flights and school instruction mileage is not included. If it were, it would increase the totals very considerably. The number of airports does not include a large number of small flying fields.

The airline and air transport operators who have amassed these impressive figures by systematic flying operations are combing the Aviation Industry and the Government Air Forces for trained men eager to develop themselves for a place in this new field of endeavor. While accurate figures covering the number of people employed by airline and air transport companies are not available, it is estimated that there was a three hundred per cent increase in personnel in 1928 over 1927. To attempt to estimate the number of men that will be required in the next five years would be to enter the realm of fancy; but I believe that the number of men needed will more than double each year.

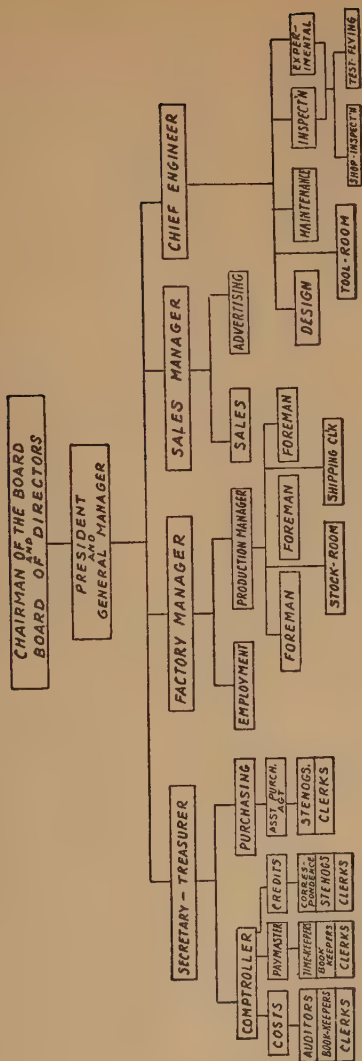
Air transportation is a new field of endeavor. While we know that it offers employment to a wide variety of workers — to pilots and airplane mechanics; to electricians and electrical engineers; to civil, mechanical and aeronautical engineers; to accounting, sales and advertising executives as well as to an army of office workers, skilled and unskilled laborers, yet, until re-

cently, little information has been available about air transport organization which the average man could study in order to learn what opportunities were open to him.

In order to present examples of the variety of factors necessary to the proper operation of a large air transport corporation, a typical Airline Organization Chart has been prepared. On it you will see many positions for which experience in other lines of business would qualify one. The chart has been dissected and analyzed and the various divisions of the transport company have been carefully weighed, in an attempt to show you definitely where you — whether you are an engineer, advertising specialist, salesman, accountant, production man, traffic expert, a general office worker, a skilled laborer or an unskilled workman — can fit into this new system of transportation, whose growth is presenting, and will continue to present, manifold opportunities for advancement to greater responsibility and higher pay.

Before taking up in detail the various factors outlined in the organization chart, it would be well to consider the future of air transportation.

As has been said before, history shows that man has adopted every new and faster means of transporta-



tion that has been devised, in spite of the great cost of scrapping the old methods and embracing the new. So it will be with air transportation. Three of the four main obstacles in the path of the full development of air transportation have already been overcome. These are (1) adequate finances (2) satisfactory equipment and (3) sufficient traffic.

Lack of capital in the Aviation Industry is a thing of the past. Any aerial enterprise that is sound and well-managed can secure all the capital it needs. Bankers, business men and the investing public are pouring millions of dollars into Aviation. In the past three years, over a billion dollars has been invested in aviation companies, and millions more are available.

Satisfactory equipment of all kinds for all classes of transport lines is available today. Transport planes with accommodations for from six to thirty-two passengers are now available; larger planes, which will carry as many as a hundred people, are being developed both here and abroad. Airports are sufficiently large to care for present needs, and new airports are being established to care for future expansion. Weather information stations are adequately equipped; airways are being lighted and equipped with radio directional beacons. The Bureau of Standards of the United States

Department of Commerce is experimenting with these and other navigational aids, as are several of the great manufacturers of electrical equipment and appliances. Lack of equipment, both flying and ground, is no longer an obstacle to the development of air transportation.

The statistics appearing in this chapter and elsewhere in this book bear testimony to the fact that not only is traffic heavy enough to support the airlines in operation today, but that it is increasing so rapidly that the problem is not one of building up, but rather that of handling traffic which is already available. The only factor, then, that is apt to delay the development of air transportation is the lack of manpower — the need for men qualified by experience and training to handle all of the many phases of the work of transport companies.

The chart and table on pages 125 and 129 give a general idea of the organization of an airline company. Various factors, such as size or extent of operations, may cause the relation of the different departments to vary, but, basically, the charts contain all the divisions and factors necessary for the smooth operation of a well organized company.

Organization

THE Organization Chart demonstrates that the personnel of an air transport firm is very much the same as that of a railroad company. Because of this similarity, a number of railroad men have found exceptional opportunities to carry on to success in Aviation with airline operators.

On the Board of Directors are, usually, men who not only have had a successful career in business, but also actual Aviation and transportation experience. Directors of railroads, steamship lines and airplane factories are usually present on the Board, their experience being supplemented by financial men, and by former government officials, Postal, ex-Army or Navy men. An air transport company which is amply financed and on whose Board of Directors appear a banker, a broker, an aircraft manufacturer, a lawyer, an engineer, a railroad official, and a flyer with years of experience is, as a rule, destined to be a great success, provided the Chairman of the Board possesses the supreme qualities of leadership and the sound judgment necessary for one in his position.

Administrative Departments

I. The President and General Manager.

In a number of Companies, the duties of the Chairman of the Board of Directors, the President and the General Manager are combined in one man in order to centralize responsibility. If this is done, this man is "Commander-in-Chief," having complete charge of finances, operations, advertising and sales, and all the other functions of the entire organization. His word is decisive in any problem, and it is he whom the stockholders hold directly responsible for the efficient and profitable operation of the business as a whole.

The General Manager must have a thorough knowledge of the principles and mechanics of the business, and should understand transportation and Aviation as well. It is needless to say that he must have keen business judgment, tact, forcefulness, leadership ability — if he did not have all these qualifications, he would never have risen to a position in which he could command even momentary consideration for a post as important as that of General Manager.

Reporting directly to him are the heads of the main divisions of the business, under whom the organization is split into various departments at the head of each of which is another executive. The main divisions are: Finances, under the Treasurer; Engineering, under the Consulting and Chief Engineers; Legal, under the Counsel who is retained by the company; Public Relations, under the Secretary; Sales, Advertising, under the Sales Manager; Maintenance, Operations and Traffic under the various Department Managers.

In each of these main divisions are a number of departments, each of which is headed by an executive and in which are employed office workers whose duties are almost identical with the duties of clerks in other kinds of business.

Under the Treasurer, for example, are grouped the Comptroller, Auditors, Cashier, Purchasing Agent, Time-keepers, Complaint-Clerks, and so forth. Each of these executive department heads requires assistants — bookkeepers, stenographers, typists, billing clerks, and many others, depending on the size of the organization.

In the office of the Legal Counsel are young lawyers who have specialized in Aviation law, as well as clerks of the various sorts found in every law office. Many new legal problems have been raised because of travel through the air, and young lawyers have exceptional opportunities of building a reputation by their handling of these cases.

Under the Chief Engineer is a force of engineers and draftsmen, inspectors and others. Their duties are to select airport sites, lay out airways and to superintend the construction of hangars and the maintenance of landing fields and radio equipment. The selection of new types of equipment of every sort, adoption of latest designs of aircraft and equipment all are left to the decision of the Engineering Department.

Sales and advertising may be either a department in itself, or it may be a subdivision under the General Traffic Manager, whose duties are somewhat similar to those of the Traffic Manager of a railroad. In either case, experienced advertising men and salesmen may find excellent opportunities for immediate earnings and future advancement.

“Public Relations” involves the handling of complaints and adjustments. As the public’s acceptance and patronization of a company are affected very seriously

by the attitude taken by the firm on complaints, this post is important and requires a man or woman of tact and diplomacy. Women, because of their innate tact, work in very well in positions where direct contact with the public is made and for them — as well as for men — there are excellent chances of assuming responsibility and winning its accompanying reward.

In addition to the adjusters, there is also a force of office workers. Here, again, the beginner in Aviation has a chance to work his or her way up to a position of trust in the Air Transport Organization.

So much for the general, or business, departments. As I have shown, in each of them there are opportunities for men and women of all types, provided they exercise good judgment and are determined, ambitious and loyal.

The Traffic Department

UNDER the General Traffic Manager are many departments in which there are positions for both technical and non-technical men and women. The scope of this department is wide, and its operations are very important to the success of the transport company.

Railroad traffic men are well fitted for the work of

this department as the problems are, in general, the same.

If the Transport Company is to show a profit, its planes must have full loads of passengers, mail or express. And these loads must be kept as nearly constant as possible, so that planes, fully loaded, can fly on regular schedules. Wide variation in loads means that equipment is overtaxed one day, and underloaded the next. It means that equipment must be purchased and men must be retained in sufficient numbers to handle the heaviest traffic — and that these men will have little work to do on those days when traffic is light. This is inefficient and wasteful.

Therefore, it is the duty of the Traffic Department to solicit sufficient business to keep equipment and personnel in constant operation.

In order to accomplish its purpose, the Traffic Department usually embraces the Publicity and Advertising Departments. Passenger and express agents, division ticket offices, salesmen and solicitors all come under the jurisdiction of the General Traffic Manager — in fact, every phase of the business which has anything to do with the traveling public as well as with shippers. The Traffic Manager supervises the plans for campaigns, and makes tariff rates. He must know not only

the capacity of his airlines, but also the business conditions in the localities over which his airplanes travel, the rates and methods of competing companies, and he must understand the operation of his airlines.

This position requires long experience in handling the public, in catering to its needs, as the Traffic Manager must sell the public on the safety, comfort, speed and economy of air transportation so that travelers and shippers will patronize his line.

On my desk are numerous booklets and letters telling me of the advantages of traveling by air. Their appeal is strong: these booklets are masterpieces of desire-creation. While there is nothing in the booklets to disclose the identity of the writers, I know that, if I go to the Traffic Department of some of these Air Transport operators, I will find there men who have written these pamphlets, men who have had experience in advertising, have felt the call of the air, and have answered that call for themselves and are now sending the message to others.

Advertising, like these booklets, and publicity go hand in hand. The publicity man is a super press-agent who sees to it that his company's operations and achievements are recorded in the newspapers, that the

name of his firm is kept constantly before the public eye.

Branch offices of the Traffic Department are maintained in important cities. In charge of each branch is a Division Traffic Manager, who directs the soliciting of business in his particular area. Ordinarily, each division covers one of the important geographical sections of the country.

By subdividing the territory covered by the airlines, closer supervision of the work of traffic solicitors is attained, and the business of each section is more thoroughly developed. Promotion work is carried on by salesmen and saleswomen — selling experience in almost any line is of value in preparing men and women for these interesting and well paid positions.

Success in selling depends more on sincerity — on a personal belief in what you are selling — than on any other one factor. To you, then, who are “sold” on Aviation, who are firm believers in its present and its future, in its safety, economy, comfort and speed, the position of traffic solicitor for an airline offers pleasant and lucrative employment.

As the providing of transportation to and from the airport falls, also, under the Traffic Department, this branch of the business offers opportunity to bus-drivers

and "starters." While these positions are relatively humble, they are a beginning which afford the ambitious young man a chance to "break in," and through which to work toward something better.

Other opportunities in this department are for general office clerks, ticket sellers, information clerks; for "couriers" or flight engineers who are members of each plane crew and whose duties are to verify tickets, assign seats, stow luggage and provide in general for the comfort of the passengers. On some lines, the courier must be a very versatile person, as he is also charged with the duty of serving luncheon on the air liner.

As the size of planes themselves is increased, and as traffic grows, more positions will become available in this as well as in other departments of the Air Transport Company.

The Accounting Department

I HAVE talked to the executives of newly organized Air Transport Companies and they have told me that it is difficult to find young men and women who have the determination to prepare themselves to be ready and able to step into executive positions as business increases and air transportation facilities expand.

These executives are looking for their successors, for men who can step into the positions these men now hold, because they won't hold them long. The growth of Aviation will take them into better positions. Therefore the opportunities are great for accountants, auditors, bookkeepers, clerks, stenographers and typists who are ambitious enough really to prepare themselves for greater responsibilities. In addition to studying the duties of those under whom you work, you should take a ground-school or home-study course, as this will familiarize you with Aviation and with the working conditions which surround the men in the field.

The Accounting Department is under the jurisdiction of the Treasurer, to whom the various sub-executives of this division report. First in line is the Comptroller, who is usually a Certified Public Accountant with considerable accounting experience. He will find the adapting of his training in other lines to Aviation work very interesting indeed, as he will have to develop new systems of controlling inventory, new methods of control, and will have to build up an organization to handle all the various details of airline accounting.

Under the Comptroller are the paymaster and cashier. Experience with industrial enterprises, with railroad and transportation companies, is excellent

preparation for either of these positions. Other means of preparing for either of these posts are by studying bookkeeping at one of the many accounting schools, or taking the "Aviation Accounting" courses which will soon be included in the curricula of our colleges and universities.

As I intimated above, the accounting practice of Air Transport Companies is comparatively new, and is not yet fully standardized. The next development will certainly be the supervision of Air Transport Companies by the Interstate Commerce Commission and the establishment of a definite system of accounts somewhat similar to the prescribed form of railroad accounting. It is also rumored that the Post Office Department will require the air mail contractors to adopt the system of accounting used by the Post Office — which, when it occurs, will offer opportunities to Post Office accountants, mail clerks, checkers, and so forth.

The Claims and Adjustment Division of the Accounting Department offers unusual opportunities for women because of their greater tact and diplomacy. The average woman can mollify a disgruntled male; but, because she has less success with her own sex, young men will certainly be employed to smooth out differences

between the Transport Operator and his feminine patrons.

Ruth Nichols and Amelia Earhart both are convinced that women have excellent opportunities in Aviation, not only in the ordinary stenographic and clerical positions, but as organizers and executives. And they are right. Women have a wonderful opportunity in the publicity, sales, public relations, educational and adjustment departments, as well as in many other fields of Air Transport work.

The Maintenance Department

BECAUSE the popular conception of Aviation is "a plane and a pilot," most people do not realize that a large "ground" organization is necessary in order to keep the plane in the air. While pilots and airplanes are essential factors of every air transport line, flyers cannot operate without both a place to land and a crew of experts to service their plane.

Therefore, one of the most important divisions of the Air Transport Company is the Maintenance Department, under the direction of the Superintendent of Maintenance. His duty is to keep the flying equipment

in active service; to see that it is repaired, tested, and kept airworthy.

Though careful maintenance is only good business, yet it is not left to the whim of the transport company. The U. S. Department of Commerce demands that aircraft be kept in perfect mechanical condition and requires periodic inspection by men who are qualified, government licensed mechanics.

For the young man, mechanically inclined, who is anxious to get into Aviation, it is indeed fortunate that the life of a plane is not indefinite; that every plane and motor needs adjustment and repair at relatively frequent intervals. This means that repair shops must be maintained, and gives to the young man the opportunity of a job as an airplane and engine mechanic.

In addition to operating the engine and airplane repair shops, the Maintenance Department must also see that the airway itself is kept in good condition, that airway lights and radio beacons function at all times. This sort of work is done by the Airway Service Division of the Maintenance Department.

While the maintenance of the airway lighting equipment is a government obligation under the jurisdiction of the Bureau of Lighthouses, this bureau has not been

able to keep up with the demand for airway lighting. Therefore some operators have been forced to install and maintain their own lights.

In general, Airplane repairs are of two types: Service Repairs and Periodic (or overhaul) Repairs.

Service repairs, occasioned by general wear and tear, are necessary from day to day to keep planes in flying condition. The replacement of parts, patching of a tear on the wing or fuselage, the adjustment of bolts, the tightening of a turnbuckle are all performed by the Inspection Department. These repairs are made by mechanics having a general knowledge not only of airplane engines but also of airplane construction. These men must hold the Airplane and Engine mechanic's licenses issued by the Department of Commerce if they work on licensed airplanes or engines.

While Service Repairs are made at airport stops, the periodic or overhaul repairs are made at the main repair depots, similar to those of the railroad shops. The repair work is distributed among several departments, generally designated as the Engine Overhaul, Machine, Electrical, Instrument and Airplane Maintenance Shops. Each of these departments is supervised by a foreman who is not only a highly skilled workman himself, but who knows the technical end of his work

and understands thoroughly its relation to the work of the other departments.

Each repair depot is, of course, under the direction of a superintendent who is a competent technical and practical man, capable of organizing and supervising the work of all the repair departments and who sees to it that each department and the whole shop is run efficiently and smoothly, with the least possible loss of time and waste of material.

Engines are removed from the plane, taken to the Engine Overhaul Shop, and are completely disassembled there. Every part is thoroughly cleaned and inspected, worn and defective parts are replaced. The engine is then reassembled and tested. If its operation is entirely satisfactory, it is ready to be remounted in the plane.

The foreman of the Engine Overhaul Shop, as well as all the men in his shop except the apprentices, must be licensed by the Department of Commerce. To secure this Engine Mechanics license, you must have two years of actual experience on internal combustion motors, at least one year of which must be on aircraft engines. And, of course, you must pass a written examination on the subject of engine repair and maintenance. At the repair depot there is usually a com-

pletely equipped machine shop in which parts and fittings are designed and manufactured and tools are made. Frequently, a plane or motor would be held out of service for days if it were necessary to send to the manufacturer for some part. Therefore, the ability to make replacement parts in the machine shop expedites getting plane and motor back into service, and saves time and money. The actual work in the machine shop is done by skilled machinists and apprentices, under the guidance of a qualified machine shop foreman. "Class A Machinists" of the Navy, as well as skilled men from other industries, will find interesting and well paid work in the Repair Depot Machine Shop.

In another part of the Repair Depot there is an Electrical Shop in which dynamos, generators, ignition systems, magnetos and the other electrical equipment of airplanes are tested and repaired. Armatures are rewound, commutators trued up, short-circuits repaired, brushes replaced, and so on.

Then there is the Instrument Shop, in which the instrument mechanic checks the altimeters, tachometers, fuel and oil gauges, and the many other engine and airplane instruments which are parts of the equipment of every airplane. Because of the jars from landing, taxiing and taking off, vibration of the motors

and changes in climatic conditions, these instruments get slightly out of adjustment and are brought in at intervals for calibration with master instruments. As the work of repairing these instruments demands painstaking care and absolute precision, watchmakers and instrument-makers accustomed to the fine adjustments on chronometers, scales and gauges are excellently fitted for service in this shop.

The work of the Airplane Maintenance shop is, probably, more varied than that of any other. The foreman must be a licensed Airplane Mechanic, and must understand thoroughly a great variety of work. He must know woodworking, painting, doping, covering, rigging, assembling — a hundred and one other things contingent upon his job.

In his shop, divisions of which are the Woodworking and Wing Repair, Fabric and Propeller Departments — there are jobs for carpenters and cabinetmakers; for painters, sheet-metal workers, upholsterers and tailors; for semi-skilled machine tool operators, for plumbers and steam-fitters, for wing-riggers and dopers, and many others. Men from almost all trades can find a place for themselves in Aviation.

In one shop, among the woodworkers, I found a man who had been with a piano-manufacturer, and every

piece of work he laid his hands on came out with a regular piano-finish! Another fellow had built organs; another had been a German wood-carver before automatic machines had taken his job away from him. Still another had been a carpenter whose specialty was building balustrades and making panellings and wain-scottings in fine residences.

Among the wing-coverers was a hoary-haired sail-maker, in whose mind, as he sewed painstakingly on every seam, there no doubt flashed pictures of the white-winged clippers, whose bellying sails he had stitched with pride and care in bygone years. Beside him was an upholsterer who had made hundreds of pieces of fine tapestried furniture.

"Women should do well at this job," he remarked as he smoothed out a seam. "They're good sewers, and careful, too."

Painters have their opportunity in the Finishing Department. After a ship has been overhauled, and any necessary structural repairs made, wings and fuselage covered, the fabric is painted with dope. This is generally a nitro-cellulose product which is air-tight and weather proof, and which shrinks the canvas covering so that it stays taut and snug over the wing surfaces. The wood and metal parts of the ship are

painted with special lacquers and with dope-proof and corrosion-resisting paints and varnishes.

There is a new trend in plane painting which should appeal to the painter who is an artist at heart, and that is to create designs similar to the coloring of our birds. The bald eagle, the cardinal and the swallow have been imitated with gorgeous effect which leaves a lasting impression in the minds of the airline passengers as well as on those who watch the plane in flight. Men who have had experience on automobile lacquer and finishing work should fit in to the finishing division of the repair shop.

Another function of the Airplane Maintenance shop is the examination of the propellers, which are inspected in the routine overhaul, as well as at airport stops. The propeller mechanic checks the balance and pitch of the propeller, and inspects its surface for flaws before passing it as being fit for service. A skilled mechanic needs only a short apprenticeship in order to adapt himself to this sort of work.

After all the various Repair Depot Departments have finished their work on the engine and plane, and after each unit has been checked and inspected, the motor is remounted in the fuselage or nacelle, and the craft is ready for its final inspection and test. Controls

are tried for proper response, instruments for accurate functioning, tires for air pressure and for weakened fabric, brakes and shock absorbers for proper deceleration, wires for tautness. The tail skid or wheel is examined, and cabin and navigation lights are tried. The engine is tuned up. After the final adjustments are made, the plane is ready for the flight test.

One day I was at the field when a ten-passenger, three-engined plane,— fresh from the shops and gleaming with many brilliant hues of lacquer,— was trundled out onto the apron. It was a beautiful piece of work — thoroughly overhauled and ready for thousands of miles of safe flying.

As I watched the pilot examining his instruments and testing the controls, I noticed a group of men in overalls standing in the doorway of one of the shops. Each department was represented in that group of men who had come to see “their job” take the air.

The pilot opened his throttles, the plane started down the runway, the tail came up, the wheels left the ground, and, describing a graceful arc, the plane rose from the earth and soared proudly over the field. Those men, standing by the hangar, their faces lifted to the sky, beamed with such unmistakable and honest pride

that I knew they were happy in their work, and took real satisfaction in a job well done.

Another department of the Repair Depot whose work seems rather prosaic and dull, perhaps, is the Stock Room. Here, however, the young man with hardware-store, or stock-keeping or mechanical experience has an opportunity to apply his experience and to learn the various parts of a plane and their uses. The work is a real stepping-stone to one of the bigger, better paid jobs in the department.

The work of all the departments that comprise the Repair Depot receives its final test at the hands of an experienced test pilot. His job is interesting, exciting, adventurous. He must be more than a mere flyer, because he must know whether the plane operates properly, whether all the adjustments are correct, whether the alignment of the plane is proper, whether the plane is safe and airworthy. He is the court of last appeal. Upon his decision rests the safety of many people as well as of a large investment. He must be able not only to pilot the plane, but also to point out to the engineers and to the shop foremen whatever adjustment he may deem necessary before he can certify the plane as safe for passenger service.

Airway Service

EVERY telephone and telegraph company has its corps of linemen whose duty it is to see that the wires are up, and that they are in good condition to transmit all messages. Railroad companies have their "maintenance of way" divisions, who see that the roadbed is kept in good condition: that the ballast is firm, the rails are spiked securely to the ties; that trestles and bridges are in good repair, that "wash-outs" are filled in with the least possible interruption to train service.

Transport lines are building up a body of men whose duties correspond to those of both the linemen and the maintenance of way crews. These men are in the "Airway Service" division of the Maintenance Department.

It is their duty — and it is an important one — to keep the radio beacons and course lights functioning. They must battle rain and sleet, scale cliffs and mountains, plow their way through snowdrifts to make sure that the airway lights and beacons are working properly, keeping the pilot on his true course.

Once each month, airway mechanics drive along the airway to inspect and overhaul all apparatus. Beacons are placed from ten to thirty miles apart. Beside

each beacon is a course light — an arrow, pointing in the direction of the next beacon.

Each mechanician is required to cover from two hundred to four hundred miles a month, more than enough to keep him busy!

Before the development of the radio beacon, the airway service man needed only to know practical electrical engineering. But the use of radio has meant that he must also know radio as well. Therefore, opportunities for both electricians and radio engineers are increasing daily as the mileage of lighted and beaconsed airways is extended.

Airway mileage increased over 14,000 miles between January and July, 1929. But the miles of lighted airways increased only 5000 miles. While the total miles of airways is about 30,000, only about 10,000 miles are lighted. Thus it is evident that there will be a large field open for electricians until all the airways are fully lighted; and, when that is accomplished, they will still be needed to inspect the equipment and keep the lights burning and the radio beacons sending out their messages.

The Airway Service division answers emergency calls from pilots who have been forced down, carrying repair parts to damaged planes. It also keeps the airports

and intermediate fields in good condition,— both the surface of the field itself and the ground equipment of the field. Here, again, are opportunities not only for licensed airplane mechanics, but also for inexperienced men in various interesting kinds of work.

Weather Observations

WEATHER plays an important part in the lives of all of us. Each one of us, before he dies, probably spends at least a year discussing the weather. To a large extent our plans are governed by the weather; our moods and our efficiency at work are affected by it. When the sun shines, we feel well and happy; when the rain falls or the weather is humid, we are depressed and irritable. Important as the weather is to each of us, it is of far greater importance to the air transport company. It governs the operations of the planes; it determines whether an airplane shall take off for the next stop, or stay in the hangar.

The Operations Manager must have correct information as to the weather all along his route, so that he can dispatch his planes on schedule or order them to postpone their flight. Therefore, the modern efficient airway is equipped with weather stations from which data on

atmospheric conditions is sent to the office of the transportation manager, to other airports on the route and even to the pilot in the air.

In charge of each weather bureau we have a meteorologist and his assistants, who record and chart weather conditions, make observations of the upper air by means of kites and pilot balloons, and prepare hourly weather reports which are transmitted to all other stations along the route by means of a teletype system. When all the reports are received, a general report is sent out from the division headquarters. At each stop along his route the pilot is handed a detailed report of the weather conditions in the area between him and the next airport. In addition to these reports received at airports, the pilot gets data on atmospheric conditions over the radio receiving set in his plane. Both adverse and good weather conditions are radioed to him, so that he knows how to lay his course, whether to fly high or low, or when to avoid an unfavorable area.

The chief meteorologist is well paid, as the duties are important and demand special training. Assistant meteorologists receive lower salaries, but these positions offer to young men an excellent opportunity to work up to larger salaries in positions which are of great service

to the traveling public. The work itself is interesting and pleasant.

Today, there are 205 regular United States Weather Bureau Stations and 125 others operated by the air transport companies or airports themselves. One of the most important airline operators maintains ten primary meteorological stations and seventy-two intermediate stations. Other companies, too, maintain their own observatories, so that opportunities are offered both in government and private service. In the 330 stations now in operation, over a thousand meteorologists are employed. The certain extension of airlines will mean a greater demand for men capable of doing this work.

The government service is an excellent training school for young men who wish to qualify as weather observers for commercial companies. The position of Junior Meteorologist in the Department of Agriculture is won by competitive examination under the Civil Service. The examinations are open to college graduates who have studied physics, mathematics and meteorology.

Radio Department

RADIO is playing a growing part in modern life, and every day it is assuming greater importance in the field

of Air Transportation. Not only is the radio directional beacon revolutionizing night flying and flying through fog, but radio broadcasting — of the type with which every family owning a radio is familiar — is making everyday commercial flying safer.

Communication is maintained by radio between the plane in flight and the ground. At each airway communication station, a radio operator and his assistants keep pilots informed of their location by means of direction-finding apparatus. Some air transport companies use radio for transmitting weather reports from station to plane and to headquarters, while others use the Teletype system.

Radio is used for orders dispatching planes, for transmitting intra- and inter-company messages as well as for sending weather data and for issuing instructions to pilots in flight. As radio apparatus is developed and perfected by experimentation, many more uses for radio in Aviation will be found.

For the young man interested in both Radio and Aviation, then, there is an ever-widening field. The continually increasing number of airlines and the greater use of radio will increase the demand — already large — for radio experts who have Aviation training or experience.

Night and home-study schools are preparing young men to take their places in the industry as radio operators. The expense of training is small, while the returns are relatively large and the opportunity, therefore, attractive.

So much for the Maintenance Department and its various divisions. In all its phases, maintenance offers an extremely wide field for men and women of all types. Mechanics, machinists, painters, woodworkers, carpenters, watchmakers, upholsterers and tailors; meteorologists, radio men and electricians; plumbers, pipefitters; stenographers, bookkeepers, cost-clerks, time-clerks, and all other office workers, both skilled and unskilled, trained and untrained, will find some niche into which they fit, and from which they can advance,—through perseverance, effort, judgment and ambition,—to high salaried positions of responsibility and trust.

The Operations Department

HAVE you ever wrestled with a railroad timetable? Have you ever become discouraged at its intricacies? And have you ever stopped to consider, as you thumbed through the timetable in search of train-connections, the amount of work that goes into the making up of the

timetable itself, and the much greater amount of work that went into the actual routing and scheduling of the trains? And the work that is necessary in order to keep these trains running on their established schedule?

All of the detail that is represented by a few pages of printed "arrival and departure" times is handled by the Operations Department of the railroad, which has its counterpart in the same department of an air transport company.

Perhaps you have read that a certain well-known transport company *completed 95 per cent of all its scheduled flights!* That is a magnificent record, when you take into consideration the effect of weather on flying. And it was made possible by the efficiency of the Operations Manager, a man whose name is a watchword in air transport circles.

The Operations Manager is in complete charge of the scheduled flying of the air transport company. His word sends planes aloft or keeps them on the ground. In order to take care of his work, he receives frequent messages informing him not only of weather conditions, but also of the arrival and departure of planes all along his airways. His office is like the headquarters of a General in battle. Reports like these are coming in constantly over the Teletype system:

“North Platte. 8:45 A.M. Field firm. Weather clear, ceiling and visibility unlimited. Temperature 53. Barometer 2997.”

“Plane DGH arrived Cleveland 2:43 P.M. Eight minutes late. Left 2:58 P.M.”

Thus the Operations Manager knows where each plane is, whether it is on time or late; what the weather conditions are that each plane will encounter on the next lap of its flight. These reports enable him, among other things, to control the scheduling of planes over the entire airline and to arrange for extra planes to carry extra loads. To him, the Radio Communications and Weather Departments report; to him, the Pilots and Field Managers are responsible.

In the performance of his duties, the Operations Manager is helped by assistants. On the longer lines, the airway is separated into “divisions,” over each of which is a Division Operations Manager who reports to the General Operations Manager.

Good men for the job are hard to find, as the positions require alertness, capacity for detail, force, tact, resourcefulness, the ability to lead and direct men and an extensive knowledge of Aviation.

At each airport, whether the field is owned by the

company or by a municipality, a Field Manager is stationed who is responsible to the Operations Manager for the efficient operation of the airport. Pilots, field men, mechanics, caretakers and the office force are under his supervision. This position is a responsible one, demanding a pleasing personality, capacity for organizing and supervising the work of others, executive ability, and considerable mechanical and flying experience. Pilot training is of great value to the man in this position. Therefore field managers are frequently selected from among the pilots employed by the airline operator.

So far in this chapter I have said nothing about the opportunities for pilots, because "flying jobs" are discussed at length in another chapter. However, an airline cannot operate without pilots, and their opportunities are many, not only in flying, but as field managers, assistant and division operations managers, and many other important positions.

Some companies require that their pilots have 2500 hours in the air — far more than is necessary under the United States Department of Commerce regulations. Requirements for second or assistant pilots are not as high, with these companies, nor with those companies

which require only 1500 hours of flying time of their first pilots.

In the air, the first pilot is in command. The second pilot handles the radio telephone and relieves the first pilot in flying the plane. Both are positions of great responsibility and require long flying experience, quick thinking, sound judgment, and a deep sense of responsibility. A good pilot is not trained in a day, a month, or even six months; but the financial reward of the man with this training is well worth the time and the determination needed to qualify for it.

Miscellaneous

As air travel's popularity is increasing, it has become necessary to provide proper facilities for serving the traveling public. Many transport companies have established terminal offices, at which a large number of men and women are required to handle all the various phases of ministering to the needs of the air-traveling public.

At such stations as Port Columbus and the Pan-American Air Terminal at Miami, men and women are employed as ticket sellers, information clerks, stenographers; in restaurants, baggage rooms, rest rooms. Dietitians are needed to plan menus for the meals

served on the air-diners. Women who have imagination are used in Publicity Departments to develop methods of encouraging women to travel by plane. As air terminals increase in size, we will see women as hostesses, as nurses and medical attendants,—in fact, in a great many positions which, a few years ago, were not even dreamed of!

At large airports, fieldmen control both ground and air traffic, signalling planes to land or to stay in the air. The fieldman is “king,” and his signals must be obeyed if the safety of the passengers is to be protected. The position carries authority and offers a fine opportunity for the young man who is alert.

There are other positions, too, which do not pay very high salaries, but which are stepping-stones from which the beginner can work his way up to something better. Among these are the jobs of “grease-monkeys,” caretakers, watchmen, ticket-takers, attendants, truck drivers and the like.

This chapter has given you a general outline of the organization of an Air Transport Company; the variety of opportunities offered in this work, and the various niches into which even the humblest of beginners can climb through perseverance, loyalty, alertness and hard work.

Though Air Travel is young, it is lusty. It is growing by leaps and bounds. Its popularity is increasing. It is taking its rightful place as one of the most important means of travel.

As it grows, it will offer ever increasing opportunities. Today, the salaries are well worth working for, as an inspection of the chart on pp. 206-07 will show. And as Air Travel becomes more popular, as revenues swell, salaries will increase in proportion. Now is the time to get into Air Transportation. Men and women who start today with an air transport company will grow with that company and will be rewarded in proportion to their growth.

CHAPTER SIX

Industries Contributing to Aviation

TWENTY-SIX years ago, at Kitty Hawk, North Carolina, a man-carrying airplane — the invention of Wilbur and Orville Wright — flew for twelve seconds. When it landed safely, without damage to itself or to its pilot, newspaper editors and other skeptics had to reconcile themselves to the fact that man really could fly.

Wood, cloth and metal were the materials used in that first primitive plane. Today, after Aviation has reached a growth beyond the wildest dreams of its pioneers, these same materials are used in varying proportions in the construction of planes that fly faster, farther, longer and more safely than that first “contraption” of the Wright Brothers.

Today the airplane has achieved a firm position in our nation-wide system of transportation. In December, 1928, we celebrated the twenty-fifth anniversary of the first airplane flight. The next twenty-five years will bring new inventions: large airliners to compete with

the railroads for long distance travel, air-flivvers for the whole family. Soon, no doubt, airplanes will be used in America for "tripping 'round" and for week-end holidays as we use the automobile now.

The growth of Aviation, particularly in the last four years, is due, to a great extent, to the number of large companies buying the capital stocks of leading aircraft factories. Observing that important financiers are putting their faith in the future of Aviation, the small investor is following their lead. The majority of these buyers own five or ten shares of more or less speculative issues. Some of these small buyers may lose their holdings, others may pyramid their winnings; but whichever way it goes, it is clear that both the money and stock markets realize that Aviation has entered the field of big business with plenty of capital.

The following tables show the growth of Aviation during the past four years with a conservative estimate for the year 1929. This information is taken from the Domestic Air News, No. 53, for May 30, 1929; from the Air Commerce Bulletins, Volume I, No. 3, August 1, 1929, and Volume I, No. 2, July 15, 1929, issued by the Department of Commerce.

The number of concerns engaged in the air industry on July 1, 1929, was estimated at 1,950—an increase of

more than 1,350 firms, or of two hundred and twenty-five per cent over the number on December 31, 1926.

It is not surprising, then, that other industries are devoting their efforts to developing products which the Aviation Industry can use, realizing the opportunity offered for expanding their factories and increasing their profits. Such concerns as Ford, Packard, General Motors, Westinghouse, General Electric, Berry

	1925	1926	1927	1928	1929
Commercial Airplanes Number ...	789	1,186	1,995	4,846	(Estimated) 10,000
Value	\$6,673,659	\$8,871,027	\$14,504,999	\$43,812,318	\$100,000,000
Total value all air products ...	\$12,775,181	\$17,694,905	\$21,161,853	\$64,662,491	\$148,700,000
Number of concerns engaged in air indus- try	(no data)	600	900	1,400	1,950

Brothers, DuPont and the Radio Corporation of America are developing aeronautical products in their research laboratories. The railroads, shipping interests, lumber mills, aluminum, textile, instrument, construction and metal companies are using their facilities to build up new fields for their services and products.

If one considers the number of basic materials used in Aviation one may gain an idea of the possibilities for development. Many kinds of wood, iron, steel, copper, aluminum, rubber, paint, glue, cotton, wool and many other products form part of the raw materials of a plane, while petroleum products are used as fuel and lubricants for aircraft engines.

Men engaged in producing any of these materials should have some knowledge of Aviation. They should understand the ultimate uses to which aircraft materials are put. A survey of Aviation and the many problems it presents may result in ideas on the surmounting of some of the obstacles now in the path of Aviation's progress and help to devise and develop new, lighter and stronger materials to replace those now in use.

Many men now manufacturing products in no way connected with Aviation should study the needs of this new industry, as it is quite probable that they can find a new market for their regular product, for some by-product, or for material that is now wasted in their manufacturing processes: or they may discover some part of a plane to the manufacture of which their machines can be turned with very slight changes in tools and dies.

From a nearly saturated market, where sales are diffi-

cult, competition keen and profits small, they may turn to the open field of Aviation — where markets are expanding at an exceedingly high rate and demand has created a “seller’s market.” Evidences of this seller’s market are the comparatively high prices of Aviation parts and accessories.

For instance, nine-cylinder radial engines, with a power output of from 200 to 500 horsepower, are selling for between \$3,800 and \$9,000 each.

At an Aircraft Show in Detroit I inspected the model of a new radial aircraft engine that has been put on the market by one of the world’s largest manufacturers of automobile motors. The engineer in charge of the booth — who, by the way, helped design the engine — was pointing out the advantages of this particular power plant over the engines turned out by some of the other airplane engine manufacturers.

When questioned regarding the present high prices of aircraft engines he replied: “Possibly they are justified in some instances, but, frankly, *we* don’t think so. Our airplane engine is designed so that it can be manufactured under the same production methods we use to turn out automobile engines. While aircraft engines will probably always be higher in price than automobile engines because of the necessity of more exacting manufac-

turing standards, we can see no good reason for placing such a high price on our product, as many other manufacturers do at present. We believe in reducing price to create demand. Why should we charge several thousand dollars for a radial engine, costing us very little more to produce and sell at a profit than a six-cylinder automobile engine, when we can sell the automobile motor for less than \$500?"

The above conversation has been quoted to show that almost any manufacturer can easily find something to make that is used on or in connection with aircraft. If the same production and sales methods are used as are used on his other products, he too can grasp the opportunity Aviation is holding out to keenly intelligent business men.

Many large companies are finding that the manufacture of airplane products is a very profitable enterprise. Optical companies are making and selling goggles for Aviators. We know of one leather belt company that has worked up a nice business making aviators' helmets. A well-known steel manufacturer has developed his war-time steel plant into one of the best paying departments of his business, specializing on the manufacture of steel tubing used in the construction of aircraft. A manufacturer of corrugated metal pipe has de-

veloped a special airport drain pipe that will withstand the shock of landings of heavily loaded airplanes weighing many tons. He is doing a satisfactory and profitable business on this new product. Another steel company is specializing on the manufacture of steel propellers and, strange as it may seem, one of our country's largest manufacturers of electrical equipment is manufacturing a moulded propeller of Micarta, a composition made of cloth and a substance similar to bakelite.

The General Electric Company recently issued the technical details of a new type of compass for aircraft. This device operates on the same general principles as the well-known Earth Inductor Compass. The General Electric Company also manufactures aircraft engine magnetos, radio devices and airport lighting equipment.

Paper and envelope manufacturers, opening the door to opportunity's first rap, have put on the market light-weight paper called "Air Mail Bond," and light-weight envelopes printed with the authorized air mail designations.

Many other concerns have embraced similar opportunities and more will follow them. The field is open and the rewards are large.

One of the largest companies supplying materials for bread has developed a side line which is quite valuable to the Aviation Industry. The history of this development is another case in point.

Some years ago, the Fleischman Yeast Company, in expanding its marketing facilities, developed a method of packing yeast for shipment. The yeast was cooled to 37° F. and placed in a box container. Balsa wood was chosen for the container because it is the lightest wood known, weighing only half as much as, and having better insulating qualities than cork. Besides, Balsa wood is very elastic, is buoyant and has considerable tensile strength. This method of shipping yeast proved very satisfactory, and it is now used extensively in the Eastern States.

The Fleischman Transportation Company, organized to import Balsa wood from Central and South America and to manufacture shipping containers, looked around for a greater outlet for its product. It found that Balsa wood could be used for streamlining on airplanes where strength was not of prime importance. A market was also developed among the model airplane builders of the country who were looking for a wood to use in building the models which they enter in exhibitions and

competitions. And now practically all airplane models are made of Balsa wood.

The demand of air passengers for a comfortable, sound-proof cabin has been met by lining the cabin walls with Balsa wool. This is a fluffy wood wool similar to extremely fine excelsior, having a thermal conductivity equal to sheep wool. Its lighter weight and greater flexibility make it ideal for aircraft use. "Ply-metal" is another insulator and sound deadener, which is made of one-inch of Balsa wood covered on each side with a thin sheet of duralumin. All of these uses of Balsa wood are the result of the imagination and enterprise of the men in the transportation division of the Yeast Company. They developed a paying business out of a sideline that, at first, was purely an item of expense.

Another concern credited with having contributed much to Aviation, is a large dental manufacturing company. While this company is primarily devoted to the manufacture of dental supplies, its research department discovered that one of its products could be used on airplanes.

One of the most important things a pilot should know, when flying, is the condition of each engine,—as indicated by the number of revolutions per minute. In

large transport planes the engines are far removed from the pilot's cockpit. As it is not feasible for a mechanic to be continually inspecting the condition of the motor, the problem was to devise some method of informing the pilot of the fluctuations in engine speed.

For some time a long flexible cable has been used to transmit the power from a motor to the drilling needle used by dentists in the so-called "painless" excavation of bad teeth.

This type of cable, with slight changes, is connected to the camshaft or crankshaft of the airplane engine, and so transmits the number of revolutions of the engine to the tachometer on the instrument board. The tachometer tells the pilot the performance of his engine by showing the number of revolutions per minute it is making. Thus a great dental manufacturing company developed another market for one of its standard products.

Three of the principal requirements of airplanes are speed, safety and reliability. To develop speed it is necessary to reduce weight. Wood can be lightened by kiln drying; or natural lightweight woods can be used. There is a limit, however, beyond which the weight of wood cannot be reduced, and the lightest woods do not have sufficient tensile strength for certain uses. There-

fore, to secure light weight with high tensile strength, we have had to turn to the development of light metals and their alloys.

Technical departments of the aluminum, steel, copper and iron companies are attempting to discover alloys of metals combining light weight with high tensile strength. They aim to produce a metal which will reduce the weight of an engine and at the same time will have the strength necessary to withstand the stresses of a greatly increased power-output.

One of the largest manufacturers of automobiles in the country is attempting to perfect a metal alloy which is stronger than nickel-steel and lighter than aluminum.

When this metal is ready for commercial use in production many problems of the aircraft engine manufacturers may be solved, and it may be possible to build engines of much less weight per horsepower, that will be strong enough to endure the strains of commercial use.

Aviation has borrowed from the automobile industry, but it has also contributed to it. Lynite, bohnalite and duralumin, used extensively in automobile cylinders and pistons, as well as in aircraft, have all been developed or improved by aeronautical engineers in their

search for light, strong metal-alloys suitable for use in the construction of aircraft, aircraft engines and equipment.

The Ford tri-motored transport plane is an example of the way in which use of metal has superseded the use of wood and fabric. The entire plane, with the exception of a few steel parts, such as motor mounts, spars and landing gear, is made of aluminum and its alloys.

Metallurgists have also been developing ferrous (iron) alloys. Steel alloys too have been made that have tensile strengths much greater than any alloys developed before the rebirth of Aviation in 1925. The increase in strength permits the use of smaller quantities of the metal without reducing the ultimate strength of the part.

Nickel, chromium and vanadium have been combined with iron to form chrome-vanadium and nickel-steel. Chrome-molybdenum is also an alloy much used in aircraft manufacture, going informally under the name of "Molly."

The study of metallurgy is interesting, but to the metal companies the research work means a larger market and better products.

One manufacturer of aluminum and bronze parts who has been supplying the automotive industry is

rapidly expanding his organization to take care of the needs of the aircraft industry. It is found that, because of the technical control that he maintains in his manufacturing processes, it is more economical for a manufacturer of engines or aircraft to buy the finished products from him than to attempt to make them. By specializing he can make these parts better and cheaper.

Aviation is now on "Dress Parade." The demand for fast passenger service has likewise created a demand for comfort. Where passengers formerly were bundled into heavy flying clothes, helmets and goggles, they now ride in their ordinary traveling clothes in an enclosed cabin plane with many of the comforts and conveniences found in the modern Pullman car.

The consequent refinement of cabin design has created a new market for manufacturers of light and strong fixtures and hardware. As the first consideration in cabin design is weight, an entirely new type of fixture has been developed from aluminum and kindred metals. The de luxe cabin planes are fitted with small aluminum wall bracket bowl lamps above the non-shatterable glass windows. Wicker chairs, because of their light weight, are used for the most part, although aluminum chairs with a light air mattress or cushion, adjustable to reclining positions, are also used. Locks,

bolts, latches, and door handles of exceeding light weight are in use.

The large planes are equipped with complete lavatory facilities, including light aluminum wash basins with tanks of small capacity.

The oil companies have also been doing their bit to advance the cause of Aviation and, incidentally, their own activities. One company in California has installed beacon lights along the length of the Pacific Coast of the United States. The lights are maintained by the company to help pilots find their way at night, when a directional beacon pointing to the nearest airport is a welcome sight. Besides serving as a guide to pilots they also indirectly advertise the products of the company, as a pilot who has been guided by one of these beacons to a safe landing is more apt to patronize the products of the company it advertises than one of its competitors.

The technical and research departments of nearly every oil company of the country are developing finer grades of gasoline. The gasoline used in the average motor car is a high-test gas but for Aviation purposes it must be even more carefully refined and purified. New oils for both internal and external lubrication have been developed as a result of recent non-stop flights.

Another oil company is installing a chain of lighted

fields located 30 miles apart, reaching from Canada to the Gulf, for the use of air travelers, and will, of course, sell the company's product.

Woodworking factories are turning to the manufacture of airplane parts such as wing spars and ribs, trim and plywood. Fabric manufacturers are making wing coverings and upholstering and are developing a type of material that they had not thought of a few years ago. A great demand for aircraft instruments is being met by new organizations who are going into the business and by manufacturers of similar devices who are producing special instruments for aircraft use.

One of the large tire manufacturers has just announced the development of a special aircraft tire and wheel combined which eliminates the use of removable tires and separate heavy wheels. This tire is of enormous dimensions and has a very low air pressure. A plane equipped with it is capable of making safer and smoother landings than could be done with the old type of aircraft tire. It is claimed by the manufacturer of this safer balloon tire that when planes are equipped with it, air, oil or rubber shock absorbing devices may be done away with. This reduces considerably the weight of airplane landing gear.

Some time ago I was on a tour of inspection of the

Ford-Stout Aircraft Factory with a group of industrial executives. Among them was an official of a large rubber factory. He kept peering all around every part of the big Ford plane, like a detective looking for a clue. And that was just exactly what he was doing, for when I asked him what he was looking for, he replied, "I'm trying to find all the places where rubber can be used on one of these things. Every piece of machinery can use some rubber product some place, and I'm finding the places where rubber is going to be used on airplanes."

Today, this man's factory has a complete line of rubber products for aircraft, which is expanding rapidly. Results of this were shown at a recent aircraft exhibition in the form of rubber washers and gaskets used on a certain plane to absorb engine vibrations and to deaden sound.

As aircraft power plants are becoming more powerful, it is almost impossible to start these large engines by hand, and the danger of starting them by turning the propeller is apparent. Therefore, the demand for engine starting devices is rapidly increasing. Already the manufacturers of automobile starting equipment are developing many styles of aircraft engine starters, mainly of the inertia or air types.

There are hundreds of landing fields already estab-

lished throughout the country and thousands more will be established in the next few years. Each of these fields must be equipped with hangars, lights, drainage systems, buildings, and all manner of equipment.

Far-sighted construction companies are specializing in building airports. Many manufacturers are offering for sale a great many varieties of field supplies and equipment. All of these improvements must be installed and maintained. This line of work alone offers opportunities in Aviation work for thousands of men and women.

Aviation insurance of all types offers another field of opportunity that is very fertile. Air transportation companies require all the types of insurance that any other transportation company demands, and aircraft factories are in the same position. Individuals in the aeronautic industry also require insurance protection of one kind or another. But the average insurance man can give the inquirer no information on aircraft rates.

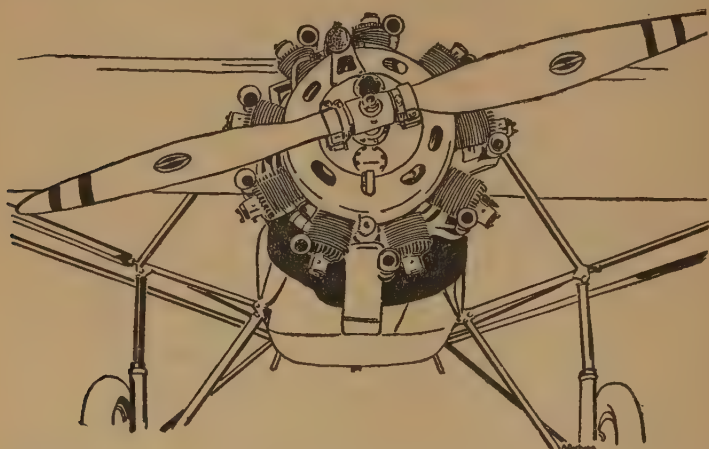
The far-seeing insurance company or agent will find this a very profitable field for him to develop and expand. Because of the lack of competition and the very evident demand, he should be able to work up an immense business in a very short time.

The first automobile manufacturer to enter the

Aviation Industry in a large way was the Ford Motor Company, which acquired the Stout Metal Airplane Company. William B. Stout, well-known aeronautical engineer, had developed an all-metal, three-engined monoplane very similar to the one developed by Anthony G. Fokker. The Ford Motor Company began to advertise (independently of their regular advertising), the safety of air travel in reliable planes. Perhaps you remember some of the titles. "Lift UP *your eyes*" was one of the first, which appealed to the reader to realize the growth of Aviation. "MAKING Port" was another, which described the illimitable spaces in these words: "For the fenceless ocean of the air knows no confining shores and those who have vision to see may look up to far lands mirrored in the sky." Their advertisement, "*Now THAT man has wings*," pictured the power controlled by the airman and showed how the radius of human activity has been enlarged to all corners of the earth by means of the airplane.

These and other eye and word pictures published by the Ford Motor Company have helped increase the number of air travelers, have educated the public to flying. The Packard Motor Car Company has been manufacturing airplane engines for the United States Government ever since the world war. During the past

year, their technical laboratory has been experimenting with a radial type of four-cycle air-cooled Diesel engine. At the time of the International Aeronautic Conference held in December, 1928, in honor of the 25th



THE NEW PACKARD AIR-COOLED RADIAL AIRCRAFT DIESEL ENGINE
Courtesy of Popular Mechanics Magazine

anniversary of the flight by the Wright Brothers, Captain Woolson flew a monoplane powered with a Diesel radial engine from their field near Detroit to Langley Field, Virginia. The Diesel engine used fuel oil instead of gasoline. On the trip from Detroit to Langley Field this engine used \$4.86 worth of fuel. The saving in fuel cost is at once apparent when it is remembered that to make such a journey in a plane powered with

a gasoline burning engine of the same horsepower, over \$30.00 worth of gasoline would be used.

The Diesel engine is somewhat similar in general construction to the gasoline engine as we know it except that electrical equipment, spark plugs, wires and magnetos are entirely eliminated. The elimination of gasoline does away with the fire hazard which has cost the lives of many people, and eliminates the weight of a carburetor, intake valves, magneto and other electrical equipment. Because of the reduced fire hazard, insurance rates on Diesel-engined planes will be lower than rates on planes with ordinary internal-combustion engines.

Other engine and automobile companies which have entered the Aviation Industry include the Continental Motors Corporation, the Lycoming Manufacturing Company, the Auburn Motor Car Company, and the Studebaker Corporation.

The Emsco Aircraft Corporation, manufacturing a tri-motored, Challenger-powered monoplane, is a development of the E. M. Smith Company, which has been in the manufacturing business for a score of years.

Berry Brothers, Titanine, DuPont de Nemours Company, Valentine, Sherwin-Williams, Cook and others are supplying the Aviation Industry with new dopes

and paints and other protecting materials for the wings and fuselages of airplanes.

The "cartridge type" radiator is the product of another group of manufacturers who have found, in Aviation, a new market for their goods. This radiator is made of the thin copper or brass tubes used in making cartridge-shells, — the tubes being drawn longer and formed into a hexagon at each end. Not only has the adoption of this type of radiator added a new market to the business of the manufacturer, but it has also helped the development of Aviation by giving it an improved method for cooling airplane engines.

As the enumeration of all the industries allied with Aviation would constitute a book in itself, it is possible here to name only the materials which enter into the manufacture of airplanes and Aviation products.

SOME PRODUCTS OF SUBSIDIARY OR CONTRIBUTING INDUSTRIES

The Airplane.

Alloy metals,—aluminum, iron and steel, copper, chromium, vanadium, nickel, magnesium and others.

Lumber and plywood.

Radiators.

Propellers.

Wicker and aluminum furniture.

Tires and tubes.

Shock absorbers—rubber, oil and air.

Insulating materials.

Instruments.

1. Various types of compasses.
2. Oil temperature indicator.
3. Water temperature indicator.
4. Air speed indicator.
5. Bank and turn indicator.
6. Tachometer.
7. Altimeter.
8. Fuel pressure indicator.
9. Fuel flow indicator.
10. Oil pressure indicator.
11. Climb indicator.
12. Clock.
13. Fuel level gauge.
14. Navigation instruments, and many more.

Paints, dopes, lacquers, and varnishes.

Fittings,—nuts, bolts, washers, gaskets.

Fire extinguishers.

Pontoons.

Wheels and brakes.

Glue and cement.

Wire.

Sewing machines.

Celluloid and non-shatterable glass.

Welding equipment.

Flares.

Fabrics for covering and upholstering.

Engine.

Alloy metals.

Ignition devices — spark plugs, wiring, batteries, etc.

Fuels and lubricants.

Forgings—castings—carburetors.

Springs.

Special machine tools.

Airports and Airways.

Lighting equipment.

Culvert and drainage tile and pipe.

Generators for beacons.

Hangars; canvas, metal and wood.

Instruments (weather).
Fuel pumps.
Grass seed.
Cement and Macadam for runways.

Personal.

First aid kits.
Parachutes.
Airplane Clothing.
Goggles and Helmets.
Publications.

This list, of course, is by no means an inventory of the parts of a plane. It is simply a summary of some of the materials entering into airplanes or used in Aviation.

If, however, it starts the train of thought in the mind of some manufacturer; if it leads him to visit an aircraft factory or an airport and inspect every part of an airplane in the search for new uses for his product, it has served its purpose. For, like the rubber manufacturer of whom I spoke, he will surely find some part which he can make or improve, and will thereby not only enrich himself and his organization, but will forward the interests of Aviation.

CHAPTER SEVEN

How Business and the Professions Use Aviation

MANY and varied are the business uses of this modern business tool — the airplane. It is changing long established practices of selling, distribution and administration. It is stimulating business, creating new trade zones, abolishing transportation limits, accelerating the dispatch of mail and changing financing methods by its speed which exceeds by three and four times all forms of earth-bound transportation.

And with these uses, there come many and varied opportunities for those who think ahead, act ahead and use this new accelerator of modern business. Just see how the Airplane has made the map of the United States shrink. Today it seems less than one-third the size it was a few years ago. The mileage from Canada to Mexico and from coast to coast has not changed, but distance is no longer measured in miles — it is measured in minutes. Fifty years ago it was 3,000 miles from Atlantic to Pacific,— *weeks* of toilsome travel over trackless plains, craggy mountains, virgin forests and

forbidding deserts. Twenty years ago it took a week of travel by railroad. Today, it is less than *48 hours* away! Forty-eight hours of swift, smooth, luxurious flight in comfortable, well ventilated and heated cabin planes, over miles of changing scenes unfolding beneath you as you fly.

The airplane has annihilated distance and time, and every American business man knows that time is the essence of progress. Time is money, true; but it is more than that — it is opportunity.

Business, realizing the value of time, is turning to the airplane. In any transaction where time is an element, progressive business men are using the plane. More uses are constantly being found for this fast, efficient carrier. Through popular education, "airmindedness" is being developed in the rising generation. The youths of today are becoming accustomed to the airplane; they are being made aware of its possibilities. And, because of their familiarity with this new mode of transportation, they will put it to a wider range of uses, when they become the business men of tomorrow.

A recent survey has shown that one hundred and thirty-five companies who are not engaged in aviation work or in the enterprises actually contributing to airplane manufacture and distribution, are using the

airplane regularly in the performance of their daily business! Some of these firms maintain fleets of planes — one rubber tire manufacturer just recently placed eight new planes in service at one time.

To enumerate the part airplanes have played in saving time and money for business men during the last few years, would be entirely misleading for the reason that the enumeration would be obsolete almost as it was being made. While I am writing this, some executive in New York or Chicago is putting the airplane to some hitherto unthought-of use.

Today, planes are being used for transporting money from bank to bank, from one financial center to another. For instance, the banks of St. Louis figure that they are saving \$10,000,000 a year in interest by clearing checks and bank drafts by plane instead of train! Checks, drafts, money orders, bills of exchange, coin and bullion are carried daily from money center to money center. Transfers of funds that formerly tied up money for days are effected today in hours. As an example — the transfer of \$1,000,000 from New York to San Francisco used to consume at least five days — a loss of \$833.00 in interest. Today it takes less than two days — a saving of \$461 in interest alone! Again, the New York Clearing House exchanges daily an

average of about \$1,000,000,000. The interest on that sum for ONE HOUR is \$11,500. Therefore, if the airplane saves *one hour* in the handling or transferring of that sum, it is saving \$11,500 every day for the bankers in New York alone!

Before many years go by, planes will fly on frequent schedules between the United States and Europe, utilizing a chain of seadromes anchored at intervals across the Atlantic. At the terminals of this trans-Atlantic route, airlines from the business centers of the interior will connect all the great cities of this country with the business centers of Europe. Documents and money that took, formerly, five to eight days to pass from London to New York or ten days from Berlin to St. Louis will be delivered in less than forty-eight hours. Again, savings in time and money,—in interest on money,—will be tremendous.

Planes are also being used for transporting news-reel films, getting these films to the projection rooms of the theatres almost as fast as the actual news has been telegraphed to the newspapers. Often you hear the newsboys shouting "Extra," buy your paper and read the headlines, then go into a theatre and see, pictured on the screen, the event about which you have just read! Motion picture producers in Hollywood send

their latest productions by airplane to "First Run" houses all over the country; or send the first completed print of a new picture to the projection rooms of the New York executives.

Some metropolitan newspapers use planes to deliver late and special editions of their papers to out-of-town and suburban news-dealers. Financial newspapers go by night air mail from New York to Chicago.

Publishers of magazines not only use the airplane for distribution, but supply them for the use of their feature writers, who are thereby enabled to cover more territory, secure more interviews, and give to the readers of the magazines the most recent news. Then, too, the use of an airplane both in editorial and distribution work stamps the publisher of any magazine as a progressive and alert business man, and impresses the reading public with the fact that the publication is just as up-to-date as the publishers back of it. The advertising value of the plane to the publisher is, therefore, very great.

Insurance companies often deliver policies, payments and investments by plane.

Expensive drugs, diamonds and jewels are transmitted by air.

Business houses and advertising agencies have found

air mail to be of tremendous advantage to them in getting advertising cuts and copy to publications before "closing" dates. Furthermore, the air mail frequently gives the publisher an opportunity to get proofs of the advertisers' copy back to him for approval because of the saving in time effected by this speedier means of transportation.

All sorts of firms use air mail for shipping their product or for distributing their advertising announcements. Fur dealers rush their furs to markets; manufacturers often have spare or replacement parts of machine-tools shipped by air mail or air express; they send out announcements of new products, rush orders of "out-of-stock" merchandise; printers sometimes ask that proofs be returned by air mail. Florists send cut flowers to exhibitions and expositions by airplane; Oregon apple shippers have used air mail for selling orders, for bills of lading, car tracers and orders for supplies; California bee-keepers have sold their surplus stocks of honey by air mail; a ship-building concern increased its sale of yachts by using air mail for a direct mail campaign; a paint manufacturer gets preferred attention by sending all quotations and sales literature to customers by air mail; department stores often send out announcements of new styles and of sales

by air mail, and "Casey" Jones, famous pilot of the Curtiss Flying Service, has actually delivered goods from a department store by airplane, landing his plane *in the street* in front of the house to which the package was consigned!

All these are particular instances. The growth in air mail poundage bears testimony to the fact that hundreds of firms are now using the air mail for everyday business correspondence. In 1927, over 1,000,000 pounds of air mail were carried over the sixteen routes then in existence. In 1928, the poundage had increased to 4,200,000, and the number of air mail lines operating was twenty-one. In the first six months of 1929, 3,400,000 pounds of air mail were carried over thirty-three lines, and preparations had been made to establish four other routes.

Progressive farmers and associations of farmers are using planes in many ways besides air mail. Large fruit orchards are "dusted" with insecticide from planes; grass, hay, and alfalfa are sowed; cotton is "dusted" with a preparation for exterminating the boll-weevil. Rice fields are planted by scattering seed from airplanes flying at a height of about 200 feet. All of this work is done much more quickly, more economically and better from the plane than by the old laborious

hand and farm machine methods. Miles of fields are planted in hours instead of in days and weeks.

Delaware mushroom growers use airplanes to transport the perishable delicacy to the hotel and restaurant trade in New York. Mushrooms picked in the morning appear on the hotel tables at noon. Refrigeration planes are used to carry loads of fresh fish from the seaboard fisheries to packing houses or direct to the retail markets. The Curtiss Flying Service in Denver, Colorado, transports loads of mountain trout weighing as much as 1250 pounds at one time to the East. Fishing fleets use airplanes to reconnoitre, and to locate schools of fish. The Norwegian whaling fleet has employed two aces of the Norwegian Army Air forces to "spot" schools of the great sea-mammals. The planes will save time in aiding the whaling fleet to reap their \$30,000,000 harvest of whale oil and bone. The Bureau of Fisheries "plants" fish eggs in inland waterways by transporting the eggs by airplanes.

No more do sailing vessels venture into the ice floes of the Northern straits in search of seals. Instead, the crews of the newer motor ships lie in wait in warmer havens while a flyer pilots his plane over the barren Alaskan coast line, watching the ice packs for signs of the precious fur-bearers. As he cruises he notes on a

map the location of the seals. Landing, he communicates this information by wireless to the sealing fleet. Then, there is a race between the boats to the richest find. Weeks of dangerous, arduous-chilling work are eliminated.

Power companies, railroads and highway commissions are using planes for photographing the territory through which they intend to erect power-lines, lay railroad tracks, or build roads. Areas that formerly took months to survey are photographed now in a few days, and the photographs present a much clearer and more accurate picture of the terrain than the topographer's blueprint! About 75 per cent of the cost of a route survey is saved by this new air method.

Boundary disputes between individuals, corporations, municipalities, states and nations are settled by aerial survey.

Cities and towns use aerial photography for surveying town sites, for tax-assessment purposes, for studying traffic, zoning, city planning and so forth. Wide-awake real estate operators show prospective purchasers the property in question by taking them over it in a plane, from which they can see much more clearly than they could from the ground, the beauties of the surroundings, the accessibility of the property and its

other advantages. This method of selling real estate—particularly country estates and industrial sites—has proved very successful and is becoming more popular with real estate operators. During the Florida Real Estate Boom an enterprising ex-army aerial photographer started in the business of supplying real estate operators with aerial photographs of property.

Exclusive shops for women's and men's apparel are getting the latest styles in clothing from the New York designing centers by air express. An alert shop in St. Louis or Wichita can feature the latest styles the day after they are displayed in the leading New York houses. With the development of trans-Atlantic airlines, the creations of the Parisian costume-designers can be delivered in New York, and worn on the street, less than two days after these costumes have been finished in Paris.

Manufacturers in the East can deliver their products to dealers in the Middle West in competition with firms on the West Coast, and vice versa.

A large candy manufacturer maintains a fleet of airplanes which are used not only for transporting salesmen, but for entertaining customers as well.

The Union Trust Company of Cleveland keeps a

plane for the use of its "flying officer," whose duty is to bring accounts of Aviation firms to the bank.

The Ford company has been operating a "cargo" plane between Buffalo, Cleveland and Detroit in which rush orders of parts and tools are carried to the manufacturing plant.

An Alaskan mining company uses airplanes for distributing supplies to its miners.

Recently one of the sub-executives of an automobile manufacturing plant saw that, unless a supply of a certain small motor part was obtained within a few hours, the motor assembly department would have to shut down. That would mean tying up the assembly line; parking motor-less automobiles in vacant lots, piling partly finished motors in every available section of the factory. It would mean that two or three hundred men would have no work to do; that expensive machinery and equipment would be idle for hours, and that, when the part was finally received, there would be considerable duplication of work because of the necessity of putting the partly finished motors and automobiles back in the assembly line. He called the attention of the factory manager to this condition, whereupon the factory manager got busy. He found that the firm manufacturing this one little motor-part had sev-

eral thousands of them on hand. He also found that there was an air taxi service in that town, two hundred miles away. He issued orders. Within the hour, a plane loaded with several thousands of these parts was on its way to the automobile plant; delivery was made inside of three hours after discovery of the shortage. Work was uninterrupted — the even flow of production was maintained. The aerial delivery cost the manufacturer several hundred dollars, but it saved him thousands of dollars in time and in duplication of effort.

A well known typewriter company dropped its product, attached to parachutes, from planes on certain occasions when the customer wanted immediate delivery and where the landing facilities for airplanes were poor. Not only did this method of delivering typewriters satisfy the customer, but it was good advertising for the typewriter itself. It attracted attention and demonstrated the sturdiness of the typewriter itself, as not a single machine was injured.

A large chain-store organization operates a "Flying Grocery Store." It is a transport plane which has been fitted with shelves and showcases on which are displayed samples of all of the staple lines handled by the chain-groceries. The United Cigar Stores operated the first

“flying store” two or three years ago, attracting widespread attention.

This new idea in merchandising will spread to other lines. Do you remember the “Clothing Store on Wheels” — a truck (fitted with racks on which were displayed men’s suits) which travelled from town to town? This “store on wheels” will be supplanted by the “store with wings,” which will attract far more attention and cover a far larger territory in much less time.

I know a prominent middle-western banker who uses the airplane today. Some time ago, he told me that it was frequently necessary for him to make business trips to another city about 400 miles away. When he went by train, he would have to spend two or three days with the business men whom he came to see because they regarded his trips both as a business proposition and as a chance for a visit. That is, they naturally took it for granted that, having made an overnight railroad trip, he would stay for a while. Now, this banker uses his own plane. It takes him less than eight hours to make the round trip. When he reaches his destination, the men he has come to see get down to business at once, and get their transaction over with in an hour or two. He then climbs in his plane and is back in his own office again on the same day. Eight hours of his time is taken

in travel, compared with the 42 hours he had to sacrifice before he began using his plane. And during the time in the plane, in transit, since he carries an assistant with him, he gets more accomplished than he would in twice that time in his office. In his plane he is not interrupted; he finds that he can concentrate and accomplish. Besides, he reaches his destination refreshed and invigorated by his trip, instead of worn out by a twenty-one hour train ride. He states that his clients have the impression that, because of his coming to see them by air, he must be in a hurry. Thus Aviation is speeding up the mental attitude of our people.

Fountain pen manufacturers have, in some instances, equipped their salesmen with airplanes.

A short time ago, certain Western cattle men were losing as high as fifteen head of cattle a day (worth about \$150 a head) because of an epidemic of anthrax. A plane was dispatched with vaccine, and the plague was stopped in three days' less time than would have been possible had the serum been sent by railway-mail. The saving in time meant a saving of \$6,750.00 to the cattle-men.

Advertising is another field of business in which the airplane plays an increasingly important part. Not only is the use of a plane itself good advertising for a

company, because it excites favorable comment, attracts attention, and convinces the buying public that the user is progressive and up-to-the-minute; but all sorts of advertising can be done from an airplane. Circulars announcing sales events or describing products can be dropped from an airplane; sky-writing can be utilized to advertise a name or brand; broadcasting can be done from a plane equipped with special amplifiers, or the plane can simply bear the name or trademark of the user. Any of these methods of advertising attract public interest and no doubt stimulate buying.

Use of aerial advertising is in its infancy; as business men's appreciation of its value grows, the present methods of aerial advertising will be patronized to a much greater extent, and new devices for advertising will be developed.

Airplanes will be used more generally by merchants and manufacturers. Executives have learned that it pays to tie up as little money as possible in raw materials; that it pays just as well to convert finished product into "sold" product with the least possible delay. Speeding up of transportation and development of dependable means of transportation has enabled manufacturers to operate safely with only a small bank of raw material on hand — on a small inventory. The

advent of fast express service permitted the manufacturer to carry on hand only a few days supply of raw material. The airplane enables him to carry on his business with only a few *hours*' supply of materials, because he can secure a new supply on very short notice by having it transported to him by airplane.

Storekeepers need keep only a limited supply of valuable goods on hand today, instead of tying up thousands of dollars in expensive stock; a long-distance telephone order to their source of supply will bring a delivery of this merchandise, by airplane, within a few hours.

The cost of transporting materials and merchandise may be high, but the saving in money tied up in inventories frequently overshadows the increased transportation costs.

A prominent manufacturer of radios recently carried out a national advertising campaign on a new model radio receiving set he was marketing. In order to tie in the sale of his product with his advertising campaign, he delivered radio sets by airplane to his dealers all over the country.

More and more companies are equipping their executives and salesmen with airplanes. Several firms have fitted up planes as "flying offices" for the use of executives who must visit out-of-town offices. One firm uses

the airplane for every trip of 50 miles or over, and finds the plane the "safest and most economical mode of travel, and a wonderful time saver," particularly on trips from 200 to 800 miles long.

Chain-store organizations use the plane for advertising as well as for transporting executives and inspectors from city to city. A number of oil companies use the plane for carrying executives from office to office and from oil-field to oil-field; their geologists travel by plane from place to place in their search for new oil lands. The legal advisers of the oil companies visit the various state capitals and county seats by airplane, in filing deeds and claims, in securing signatures to leases, and so forth. The salesmen of these oil companies also use planes for making calls at airports and on factories using their gasoline, oils and greases. The executive of one oil company says:

"We have a fleet of five company-owned airplanes today. Within the next five years, we will have between thirty and thirty-five planes in company use. Each new use to which we adapt the plane in our business leads to still more uses. To us, the airplane has become a positive *necessity*."

An advertising agency uses the airplanes, not as an

advertising stunt, but as a vehicle for keeping its executives and contact men in closer touch with clients. Many of its clients are located two hundred miles away. The agency contact man, by using the plane, can confer with several clients in one day, while, before this firm adopted the airplane, one call a day on out-of-town clients was the usual limit.

The directors of another large company were called to a meeting in New York City. One of them had to stop in Detroit to collect certain data on which the board of directors would base an important decision at their meeting in New York. Climbing into a plane at the same time that his colleagues were boarding the "Twentieth Century Limited," he flew to Detroit, secured the necessary data, flew on to Toledo, where he made another business call, and was at the New York Central Railroad Station in Toledo thirty minutes before the fast train, carrying his fellow-directors, pulled in!

Those companies actually engaged in the Aviation Industry have, naturally, taken the lead in putting the airplane to work. Not only do they use planes for transporting supplies and materials, for carrying their executives from place to place, but they have equipped most of their salesmen with planes. This is true not only

of the airplane salesman, who flies and demonstrates his plane much as the automobile salesman has demonstrated his car for years; but also it is true of the men who sell aircraft accessories and instruments, airplane fabric and finishes; tires, landing gear, wheels, and a hundred other products that go into the manufacture of the plane. Paint and varnish manufacturers; tire manufacturers; instrument makers; steel and metal mills, aluminum smelters; lumber and plywood dealers; textile mills, furniture manufacturers; makers of goggles, helmets and flying clothes; propeller manufacturers; electrical and radio firms, and a host of others have given their salesmen wings.

As many of the manufacturers of these products have installed landing fields at their factories, it has become advisable for the concerns selling products to this large group of firms to equip their salesmen, too, with planes. Thus, starting with the airplane manufacturer, an endless chain of companies whose salesmen use the airplane has been started. New links to this chain are being added daily: before many years go by, the chain will include almost every industry in the country!

Professional men, too, are adopting the airplane. Lawyers are using it for trips to state capitals, to

county seats, to out-of-town clients. The judges of a circuit court in Arizona were transported by plane recently to the various cities in which the court met.

Engineers have been using airplanes for surveying for several years. This use of the plane convinced them of its practicability and economy as a vehicle of transportation, not only for surveying and prospecting, but also for travelling to conferences with clients; for visiting the scenes of construction jobs and engineering projects.

No doubt we shall soon see the use of airplanes by doctors who call on patients scattered over relatively wide areas; and also, for the use of specialists who are called in to consult and operate in emergency cases all over the state or country. Serums, vaccines and anti-toxins have been dropped from planes to communities isolated by flood, by snow storms or hurricanes. Relief workers have been carried to stricken areas; food, medicines and first-aid equipment have been delivered by planes to refugees from storm and flood. Patients have been carried from isolated sections to city hospitals for treatment or operations. The use of the plane in these emergency cases has helped to make the doctor air-minded, to show him that he can use the airplane in the daily practice of his profession.

Architects, too, can use the plane. From it they can study the sky line of a whole city, or of any particular section of a city for which they have been commissioned to design a building. By getting a picture of the whole section — of the surrounding buildings — they can decide more easily what type of building and what style of architecture will be most suitable, most practical, and most beautiful for the particular site on which that building is to stand.

As I said before, it is practically impossible to enumerate all the uses to which business and the professions have put or will put the airplane. An endless chain of airplane uses has been started; each new link in the chain revealing new uses, adding still more links. How long the chain will grow, how wide a field it will embrace, is beyond my power to predict.

I foresee the adoption of the plane by every industry, by every type of business, by all the professions. I will live to see thousands of planes circling overhead, winging their way swiftly, safely, and surely to their destinations; carrying doctors, lawyers, engineers, accountants, salesmen, buyers and countless other business men and executives from office to office, from city to city, even from nation to nation, in the everyday performance of their daily duties.

TABLE II
SALARIES

AIR LINE AND AIR TRANSPORTATION COMPANIES

	Low	Average	High
President and General Manager.....	\$10,000	\$25,000	\$50,000
Consulting Engineer (retaining fee)....	1,800	2,500	4,000
Counsel (retaining fee).....	1,800	2,500	4,000
Secretary and Treasurer.....	7,500	10,000	15,000
Vice President in charge of Public Relations	7,500	10,000	15,000
General Operations Manager	6,500	15,000	18,000
Assistant General Operations Manager..	5,000	6,500	7,500
Division Operations Manager.....	4,500	6,000	7,000
Field Manager	2,400	3,700	5,000
Assistant Field Manager.....	2,100	3,250	3,900
Chief Meteorologist.....	3,250	4,750	6,000
Meteorologists	2,400	3,000	3,600
Observers	1,600	1,800	2,000
Chief Pilot	8,000	12,000	14,000
First Pilot (Base pay, \$3,000).....	6,000	10,000	12,000
Second Pilot (Base pay, \$2,000).....	4,000	8,000	10,000
Chief Radio Engineer.....	3,000	4,800	6,000
Station Radio Operator.....	2,200	2,400	2,600
Station Radio Operator, 1st Assistant..	1,700	1,800	2,200
Station Radio Operator, 2nd Assistant..	1,500	1,650	1,800
Caretaker	800	900	1,000
Fieldman	1,140	1,200	1,800
Chief Plane Inspector.....	3,400	3,640	4,800
Airplane and Engine Mechanic.....	1,800	3,400	4,000
Utilitymen	800	950	1,040
General Traffic Manager.....	6,000	8,000	10,000
Publicity Manager.....	4,000	6,000	7,500
Advertising Manager.....	4,000	7,500	10,000
Division Traffic Manager.....	3,500	6,000	7,500
Solicitors (plus commissions).....	2,400	2,600	2,750

Superintendent of Repairs and Supplies.	5,000	6,000	7,500
Assistant Superintendent of Repairs and Supplies	3,900	4,100	5,000
Chief Engineer, in charge of Maintenance	5,000	7,500	10,000
Draftsmen	1,800	2,800	3,600
Chief Mechanic.....	3,500	3,800	4,200
First Class Mechanic	2,400	3,500	3,640
Second Class Mechanic	1,800	3,100	3,300
Machine Shop Foreman.....	3,000	4,100	4,800
Machinist	(\$1,800 up) 2,300	3,000	3,500
Welder	1,800	2,500	3,500
Chief Propeller Mechanic	1,920	2,800	3,260
Chief Woodworker	1,920	2,800	3,260
Chief Sailmaker	1,920	2,800	3,260
Chief Instrument Mechanic.....	1,920	3,000	3,600
Test Pilot.....	4,000	6,000	8,500
Comptroller (C.P.A.).....	4,500	7,500	12,000
Purchasing Agent	3,600	6,000	9,000
Cashier	2,800	3,500	4,800
Paymaster	2,800	3,200	3,600
Auditor	2,300	2,500	3,000
Time Keeper's Clerk.....	1,400	1,600	1,800
Utility Clerks.....	1,200	1,500	1,600
Bookkeepers	1,800	2,000	2,400
Stenographers	900	1,560	2,000
Clerks	900	1,040	2,000

CHAPTER EIGHT

Airport and Landing Field Opportunities

IN the days when forty miles an hour was fast flying, any meadow or cowpasture made a good landing field. On the seventeenth of December, 1903, the Wright Brothers took off and landed in the sand dunes of Kitty Hawk, North Carolina. In 1908, the first plane delivered by Wilbur and Orville Wright to the United States Army was set up on the retreat parade ground at Fort Myer, Virginia. This plane's top speed was about forty miles an hour, and its landing speed about half that. It could be manœuvred very easily for take-offs and landings on the small, rough field used by the post for a parade ground.

At the twenty-fifth anniversary of the Wright Brothers first flight, delegates from all parts of the United States and from almost every country in the world assembled at Washington and went from there to Kitty Hawk by steamboat. None of them flew down, because modern planes cannot alight in sand without doing a "ground-loop" or snapping an axle.

Today, no pilot flying a modern ship would attempt to land on a field as small as the parade ground at Fort Myer, unless he thought nothing of his neck or plane, for the reason that most commercial airplanes made today have a *landing* speed faster than the fastest airplane could *fly* in 1905.

As speed is the dominant factor in the rise of Aviation, the development of fast flying has, so far, also increased the landing speed of a plane, thus naturally necessitating larger, smoother landing fields. While the need for larger fields is being counteracted in part by the development of airplane brakes, yet safety demands a much larger landing field than was needed twenty years ago.

While there are several thousand landing fields in the country today, most of them are in poor condition, or are surrounded by trees, high tension electric wires, and even by tall buildings. Such fields are a menace to the safety of the flying public and constitute a stumbling block to Aviation's progress.

Fortunately, however, business men in village and city are becoming air-minded. Business men's clubs, like the National Exchange Club, and the Chambers of Commerce, are devoting their time and money to foster the establishment of suitable airports and guide

marks for aviators. On August 15, 1929, the Department of Commerce had received notices of 1174 proposed airports which would be developed within the next year — and developed along the lines suggested by the Department of Commerce!

On that date — August 15 — the Department of Commerce announced that there were, in actual use, 428 municipal airports; 439 private and commercial airports; 263 lighted intermediate fields; 70 Army, National Guard and Reserve airports; 14 Naval and Marine airports; and 271 marked auxiliary fields — a grand total of 1,485 airports. This figure is of course much greater today. The next few years should see the addition of several thousand more airports, adequately equipped and designed to meet the needs of today's planes.

Fortunately for flyers, aircraft operation is largely interstate and, therefore, falls under Federal control. Under the Air Commerce Act of 1926 — one the most beneficial pieces of legislation passed by Congress in recent years — the Department of Commerce has regulated air transportation in all its phases, from the employment of men to the selection of routes and equipment, the erecting of airport buildings and the size and design of the field itself. Under the Department of

Commerce, standards have been worked out which promote the safety of the flying public.

These regulations provide that a landing area of suitable size be used; that the vicinity of the airport be free from obstructions which would tend to diminish the actual landing space for planes; that the airport be situated on a good road leading to the nearest city or town; that it should be marked in such a way that it is easily distinguishable from the air; that means for indicating clearly the direction of the wind be provided; that the runways be built to withstand ordinary loads and the shocks of landing; that the field be drained so that the airport is usable in good or bad weather. Moreover, before an official rating is given, the airport must provide facilities for supplying aircraft fuel, oil and water, and must have attendants on duty at all times or available on short notice.

While there have been many instances in which public-spirited and air-minded citizens have developed their own airports by actually going out to a field, rolling up their sleeves and doing the manual labor, the construction of an airport is not a job for the amateur Aviation enthusiast. Safety of planes and their cargoes, both people and merchandise, demands that an airport be properly constructed: that the field be level, smooth

and properly drained, the runways strong and laid out in the direction of the prevailing winds, the buildings properly designed, and the field equipped with the proper lighting for night flying. This work requires the services of a competent civil engineer well-versed in Aviation and its problems, of which the average man knows little; of drainage, of the direction of the prevailing wind, of the many factors controlling the selection of a suitable site.

Because the work of selecting the proper location for an airport and the construction of proper buildings is highly specialized, a number of large construction companies have organized "Airport" divisions which do nothing but design and build flying fields. The development of these companies has provided many opportunities for young men in the engineering profession, as well as for the man with building-trade experience, or with little training in any particular line.

The work of these companies falls naturally into three phases: the grading of the landing field proper and the construction of runways; the erection of buildings,—hangars, offices, shops, etc.; and the installation of equipment.

The greatest number of men employed in the actual leveling of the airport site and in the laying of the

drainage tile are unskilled laborers. Some operations require a steam shovel and the necessary fireman and engineer, but more often the site selected is comparatively level, so that scrapers and trucks can handle the leveling and filling in. Other workers dig the trenches for the porous tile pipe, perforated cast iron, or corrugated, perforated galvanized steel pipe used to drain the landing area in wet weather. A steam roller is employed to roll the field flat so that any depression or hump which might interfere with the proper taxiing, or take-off or landing of a plane, is levelled. The concrete, macadam or cinder runways, running in the direction of the prevailing winds, are laid, the remainder of the field is planted with grass or oiled, and the work on the field proper is finished. All of this work is supervised by an engineer and his assistants.

Next comes the erection of hangars, service shops and the administration office. Here we need skilled workmen of the building trades, for the majority of the hangars being erected today are of steel girder construction. Iron-workers, drillers, forgemen, riveters, and welders are in demand for large hangar jobs. Carpenters, masons and electricians are needed in finishing the hangars and in erecting and finishing the other necessary buildings.

In the work of installing the lighting, weather reporting, radio communications, office and shop equipment — part of which is carried on while the buildings are under construction,— men trained as electricians, lighting engineers, radio engineers, mechanics, millwrights, plumbers, plasterers and so on are required. The electrical work is rather intricate, because of the number of lights of different capacities required and the radio, telegraph and teletype installations. Lights are used not only to illuminate the buildings, but to outline the boundaries of the flying field, to light the runways, to indicate that particular runway on which a landing “into the wind” should be made, to mark obstructions on the field and around the airport and to act as revolving beacons.

Lighting of the airport is essential to the pilot who is in the air at night. While circling the airport to find the direction of the wind, he throttles his ship and glides to that landing strip aligned with the wind at the time. White lights show him the boundaries, and green lights show him the axes, of the landing strips. By keeping between the strip boundary lights, he brings his plane down on the runway and taxis to the illuminated apron in front of the hangars.

The men responsible for the installation and func-

tioning of the airport lighting equipment are not ordinary "house-wiring" electricians, but are men who, through a study of electrical engineering and of airport conditions and requirements, are thoroughly versed in the technique of airport illumination. Because conditions are changing, and because new equipment and systems for airport lighting are being designed to meet these changing conditions, this type of work is extremely interesting to the man with a liking for electrical work.

On the installation of apparatus for the weather reporting, radio and teletype systems, highly skilled men are required. These men are usually factory trained. The manufacturers of the various instruments — for recording the velocity of the wind, measuring the altitude of the clouds or "ceiling," radio broadcasting, telegraphing and teletyping,— send out their own service men (all specialists trained in handling and calibrating these delicate instruments) to install the equipment.

When all this work has been completed, the airport is ready for service. In the building of the airport, there are opportunities for unskilled laborers, for building-tradesmen of all types, for electricians; for surveyors, linemen, civil and electrical engineers. In

the actual operation of the airport there are opportunities for some of these same men, as well as for numerous workers in other lines.

With the increase in air traffic, I believe that airports will fall eventually into four categories. First, terminal airports (usually municipally owned), for the taking on or discharging of passengers, mail and express. These airports will be reserved for the sole use of air transportation lines operating over scheduled routes.

Second, service airports. These will be similar to the neighborhood garage, providing repair facilities and hangar space for private owners. Carried on at these airports will be the non-scheduled flying like sightseeing, air-taxi and other commercial air services. Third, flying school airports which will be devoted entirely to student instruction and student flying. Fourth, private landing fields of individual airplane owners, of country clubs, and of companies not directly engaged in the business of supplying air transportation to the public.

The terminal airport should be a municipal enterprise controlled by the city near which it is located or possibly by the county or state. It should be maintained by public funds, just as our public parks, golf courses and playgrounds are maintained. Because of the tremendous interest in Aviation, and because all air activi-

ties will center around the terminal airport, it would probably prove profitable for the city to provide facilities for recreation and entertainment for visitors to the airport, charging a fee for the use of these facilities. Thus, the city would derive a direct income from the airport besides receiving all the commercial advantages which the establishment of an adequate airport brings.

A notable example of an airport serving as a recreation center for the people of the city is the Tempelhof Aerodrome at Berlin. The airport is located within the city limits, and is reached by street car and bus lines. Thousands of people pay a small fee simply to be admitted to the grounds where they can watch the arriving and departing air-liners. Establishment of amusement facilities would draw thousands more, increasing the revenue very substantially. Operation of amusement concessions and refreshment stands would offer employment to hundreds of people.

Management and administration of the airport should, of course, be in the hands of competent executives with sufficient business and aeronautical experience to administer and regulate properly the functioning of the airport. The executives handle all the business details of the airport, such as the leasing of hangar space, the erection of buildings, making of contracts,

receiving monies from airline and concession operators using the airport, controlling the personnel and policing the airport. I have been told, on good authority, that the managers of some of our large municipal airports receive a salary of better than \$10,000 a year, which shows that the position requires a man of ability.

The Airport Station of today is a busy place, and it will grow busier as time passes and air-travel comes into its own. In it are found ticket office, baggage and express rooms, in which there are opportunities for the young man interested in Aviation. As the airport is the place where the air-traveler first comes into contact with the air transport company, and receives his first impression of the airline operator, the opportunities for men of tact, diplomacy and sales ability are manifold.

Then, too, there are the usual facilities for communication found in any hotel or railroad station — the telephone, telegraph, cable and radio offices. The people in these offices need no special Aviation training; but they have here a vantage point from which they can observe the various phases of airport and airline operation and from which they can advance into actual aviation work.

Air-mail post offices also offer opportunities to many people. Employment is secured through Civil Service

examinations. Some of the jobs are flying mail clerks, airport branch office clerks, et cetera.

The government is also represented at terminal airports in a "port of entry," by two branches other than the Post Office. One is the Customs Division of the Treasury Department. Customs inspectors check all luggage brought into this country from Canada and Mexico, going over customs declarations, collecting duties, confiscating undeclared and non-importable articles. Representatives of the Immigration Bureau of the Department of Labor visa passports. As in the Post Office, positions in both these governmental agencies are secured by those receiving the highest grades in competitive Civil Service examinations.

Freight and express companies also are represented at the airport. The volume of merchandise shipped by air express has more than doubled in the past two years, thus requiring more clerks to handle the increased traffic. Clerks of the express companies must be familiar with the procedure of their own companies, and at the same time should know something of air transport operation. The tremendous increase in air express calls for more men at these airport offices. The man who is familiar with airline operation will win promotion.

The regulations covering the highest rating of an airport, require suitable sleeping accommodations at the field for field personnel and a reasonable number of pilots and mechanics attached to transient planes stopping at the port overnight. The Croyden and Tempelhof aerodromes, respectively situated at London and Berlin, have each, an hotel, a restaurant, a café and outdoor refreshment gardens for comfort and convenience of air passengers and visitors to the aerodromes. The first American airport hotel was recently opened at the Oakland Municipal Airport which serves the San Francisco Bay region of California. It contains 37 rooms, ticket offices, restaurant and rest rooms. At present, the airport personnel make up the greater number of the guests. Air passengers are using the restaurant for early morning breakfast, however, and already there is an indication that air travelers prefer to stay at the airport overnight immediately previous to a long air trip. It is quite natural that they should, as after a refreshing sleep they have only to eat their breakfast unhurriedly and walk out to the waiting airplane. Hurried taxicab trips with the consequent mental strain are eliminated and the traveler is in a proper mood to enjoy the shifting panorama viewed from the sky.

A nation-wide chain of airport hotels has been proposed and it will not be long before they will be doing a rushing business. This development is presenting new jobs to young men in the hotel business and to many others still looking for an opportunity. Hotel work is highly specialized, as the employes are divided into two sections, those who have direct contact with the guests and those whom the guest never sees but who form the greater number of employes. These sections are called the "front" and the "back" of the house.

The "front of the house" employes include the manager, room clerks, bell-boys, accounting and executive force. Housekeepers, restaurant employes, cooks, kitchen help and the engineering employes constitute the back of the house force. All of these positions offer a future, for the airport hotel business is growing with Aviation.

The development of airports, the expansion of air travel, and the growth of aerial services have created a situation in which there are untold opportunities for the business man. Many of these opportunities, such as the operation of amusement concessions at or near airports and the proprietorship of adjacent shops catering to the personal needs of air travelers, demand no special knowledge of Aviation. Any man with a little

capital, some business experience, some ability, and the courage to start can open a store selling any number of commodities to the patrons and personnel of the airport. Drug stores, soda fountains, souvenir shops, news-stands, haberdasheries, notions — these and many other articles can be sold to the ever increasing numbers who visit the airports daily.

Then there are excellent chances for dealers in repair parts of airplanes and engines; for men handling aircraft fabric and finishes, steel tubing, sheet metal, propellers, instrument parts, helmets and goggles, flying togs, tools and hardware. Customers are the airport personnel — mechanics and pilots; students at the local ground and flying schools; owners of air taxi and express services, and men who fly their own planes in business or for pleasure.

The greatest opportunity, and at the same time the one requiring the most ability and business courage, is for the airplane dealer. The man who obtains a franchise for selling the product of a recognized airplane manufacturer (particularly the smaller open and cabin jobs), will enjoy the advantages of a "seller's market." He will have to work hard, but the work is pleasant, there is a satisfaction, a thrill in it that no other business can offer. Prospects are abundant: twenty-five per

cent of the owners of automobiles today are live, legitimate prospects for the airplane salesman.

Selling ability is essential in this line of work, just as it is in handling automobiles. Many aircraft manufacturers are trying to build up sales organizations around automobile dealers, knowing that automobile salesmen, as a rule, make good airplane salesmen. Automobile manufacturers themselves are going into the production of aircraft. They are beginning to realize that the merchandising problems of the Aviation and the Automobile Industries are very much alike, and that the automobile manufacturers have already built up sales organizations that provide an excellent nucleus for airplane selling campaigns.

My statement that the man who secures an airplane sales franchise will enjoy a "seller's market" may surprise you. But the statement is true. Market conditions have changed since the War. At that time, a few aircraft factories had been built to considerable size, and were turning out planes and engines on a quantity basis to fill Government orders for military planes. The signing of the Armistice terminated the demand for planes. Manufacturers were left with surplus stocks of finished and partly finished planes and engines on their hands. Aviation then was regarded as a wartime ac-

tivity — it was a very dubious experiment as far as any commercial use for airplanes was concerned. There was no market, then, for the surplus stocks of the manufacturers, nor for the thousands of knocked-down planes stored in Government warehouses. In the language of Wall Street, “the bottom dropped out of Aviation.”

Planes that had cost the Government \$60,000 were hard to sell at less than \$1,000; motors that cost \$9,000 went for a few hundred dollars. The few buyers were able to dictate their own prices and terms. Today, all that is changed. Surplus war stocks have been consumed. Manufacturers have more orders than they can handle in spite of enlarged plants and expanded manufacturing facilities. Many plants are accepting orders for “future delivery” only and are unable to make delivery for several months after receipt of the order.

This is a very happy position for the aircraft manufacturer. But, realizing that this condition cannot last unless he puts some sales effort back of his product to maintain the demand for it, the manufacturer is not sitting back and waiting for orders. He is going out after more business, building up a real distributing organization and signing up dealers who will aggressively push the sale of his plane.

Ten years ago, the automobile was considered a luxury. Today, it has become a necessity. There is now one automobile in use for every five people in the United States.

The desire for automobiles has been built up by advertising and selling. Ownership of automobiles by the masses has been made possible by installment selling methods.

Demand for airplanes is being created in the same way, and it is now possible to purchase an airplane on practically the same terms on which automobiles are bought. Thousands of people are learning to fly; tens of thousands will learn in the next few years. The whole civilized world is becoming "airminded." While many people of this generation are still afraid of airplanes, the rising generation has long since lost all fear and has accepted the airplane and air travel as a matter of course. In a few years, airplane ownership will not be the prerogative of the millionaire, it will be almost as common as automobile ownership. The business man who gets an airplane agency today will certainly "cash in" in the future!

At the other specialized types of airports, as they are developed, many more opportunities will be presented, though the terminal airport will always, of course, be

the center of Aviation activity and will offer far the greatest number of opportunities to the non-flyer. Accessory and repair shops will be found eventually at all flying fields. Dealers in airplanes will move to the "service" airports, as the terminal (municipal) airports are gradually turned over to transport companies for scheduled flying only. Today, the municipal airport is a combination of all four types, but this condition cannot exist for very many more years.

Private airports are being established by various firms in the aircraft manufacturing business, or in industries contributing to the manufacture of aircraft. Business houses selling to firms owning flying fields will gradually equip their salesmen with airplanes and will eventually establish their own landing fields. An endless chain has been started and new links are added daily as more and more industries are becoming involved in Aviation, by the use, sale or manufacture of aircraft, aircraft parts, supplies or equipment.

Business men will find a profitable field in servicing these commercial users of planes and airports and the airplane dealer will make new "prospects" of the businessmen of his community by selling them the idea of using airplanes in their business. Another type of airport which I am classing as "private" is the one de-

veloped by the real estate man in marketing his "Aviation Country Club" development and similar projects.

Forward-thinking real estate men are developing airport communities within a 100-mile radius of New York City. They handle a "prospect" in the following manner :

First, they convince him of the advantages of owning a home in the country: of the benefits his children will receive from living in the cool fresh air in the country; of the idea of being within easy reach of the nearby Aviation Country Club, where golf, tennis and swimming, as well as the flying facilities, can be enjoyed.

The Prospect may reply: "Well, Mr. Real Estate Man, you have painted a very nice picture of life in the country, of the recreation facilities and the educational possibilities for my children, but how am I to control my business if I am 100 miles away? Besides, my wife has to visit the city shops, as all women do. How is she going to reach the city?"

The Real Estate Man replies: "Mr. Prospective Home-owner, our property is known as Airport Town. All the homes are not more than a five minute automobile ride from the airport. A plane takes off each morning at a quarter past eight and lands at nine-thirty at the City Airport, a short ten minutes from your office.

In the evening, there are several scheduled planes leaving the city Airport at four, five and six o'clock, which gives the business man a choice in the hour for riding home. Then there is a special plane leaving Airport Town at half past ten in the morning which will bring your wife into the city in time for a light luncheon before she shops. Besides the plane service I have mentioned an hourly service is run all day, with a special plane leaving the city late in the evening to accommodate theater-goers. Besides the regular transport line, you can have your own personal plane service by paying a small monthly rate for airplane taxi service, or you can own your own plane.

"Complete facilities at Airport Town for storage, service, and maintenance of your own plane are available. A number of my clients, now owners of homes in Airport Town, own their own ships; in fact several of them own two or more. This is a flying age, Mr. Prospect. If you really wish your children to have equal advantages with other children, you must educate them from infancy to the thought of flying."

That is one way in which flying will be developed in the next few years. Architects have planned what they call circular cities, with a central airport from which radiate traffic lines in all directions. The plan is to

have each section of the city only a short distance from the airport.

The Lehigh Airport competition sponsored by the Lehigh Portland Cement Company will result in many new suggestions for the construction of model airports and cities. The architectural plan for airport buildings has been considered but lightly in the past. But an effort is being made to develop a distinct type of architecture conforming with airport regulations, which require that buildings must not be over two stories in height. This necessarily makes the buildings appear squat, to overcome which the buildings at one of the Transcontinental Air Transport Company's airports are developed along the lines of Spanish architecture.

No provision having been made for airports in most of our American cities, the airports are usually located on the outskirts. The air traveler flying from city to city gains time between airports but loses it in getting into the city proper. This is a condition that will some day be corrected, no doubt. But where the city is situated near water (river, lake or harbor), the air traveler can be transferred from the airport by a "shuttle-service" of amphibian flying planes which will land on the water within a few minutes of the business section of the city.

New York is a city where such conditions prevail. There are numerous airports within the metropolitan area, but it takes an air-traveler from thirty to ninety minutes to reach the business section after landing at one of the airports. Even the municipal airport at Barren Island is far removed from Wall Street. The only solution for good transportation is to install such a shuttle-service as I have mentioned.

While there have been many devices patented for utilizing the roofs of buildings as landing fields, none of them have proved practical to date. One inventor proposes to use a sloping platform with a special retarding mechanism which will quickly stop the plane. Another inventor uses powerful magnets to retard the forward motion of the landing plane. In tests using models, this invention has proved satisfactory, but whether it is practical with large ships is still to be determined.

Besides the 1485 land airports in use in the United States, there are floating airports,—the steamships *Langley*, *Lexington* and *Saratoga*, operated by the United States Navy. These aircraft carriers were converted from battle cruisers which were in the course of construction at the time of the Washington treaty for the limitation of naval armaments. The original hull

was reconstructed and a long deck built over its whole length. This deck is free from all obstructions so that a land plane may safely land or take off. The ships are equipped with full facilities for making service repairs to planes. The *Lexington* and *Saratoga* carry a complement of about 1400 enlisted men and officers. They are a floating airport and a city combined and, as such, furnish a fairly good example of the number of men required for maintenance in proportion to the number of actual flyers, or pilots.

According to the official figures contained in the Congressional Record, the Navy Aircraft Carrier U. S. S. *Saratoga* carries fifty-four officers whose duties are purely for Aviation, and who have official Aviation ratings. The operation of the vessel and the fighting strength requires an additional seventy-nine officers, making a total of one hundred and twenty-three officers on board. This shows that two-thirds of the officers on this vessel are either aircraft pilots, observers, airographers, photographers, radio or other Aviation specialists. It is necessary that this ship carry these 79 line officers in order to make it possible for the 54 Aviation officers to fly planes.

The *Saratoga* also carries two hundred and eighteen enlisted men who have Aviation ratings—but there are

many more enlisted men aboard who are not rated as such but whose entire duties are in connection with Aviation. For instance, many Machinists mates (this is not strictly an Aviation rating) on the *Saratoga*, are assigned to aircraft maintenance work but, on the records, are not classed as Aviation Personnel.

In the entire U. S. Navy at present 12.8 per cent of the personnel of 84,000, or a total of 10,771 men, are officially assigned to and rated for Naval Aviation. The entire U. S. Navy has a little less than 700 officers, warrant officers, and enlisted men who are rated as Aviators and who are qualified to pilot airplanes or dirigibles. From this it can be seen that 17 men are required on the base of operations doing Aviation duty, in order to keep one man in the air, and this ratio does not take into consideration the number of individuals employed in the factories that make airplanes, aircraft engines, instruments, supplies and equipment for the Navy.

The principle of the floating airport has been further developed by an inventor named Armstrong. Several years ago he obtained a patent on a floating-island field, the model of which proved satisfactory when tested in a floating basin. The first experimental island, now being built, will be a steel platform, 1200 feet long

and 400 feet wide. The platform will be mounted on enormous steel cylinders which are to be anchored at a depth several times the height of the platform above the water. The cylinders will extend below the usual depth of wave disturbance. The distance above water will normally be 100 feet above the waves. The first island, to be anchored halfway between Bermuda and New York, will have a crew of forty-five men. It will be equipped with a hotel, restaurant, repair shop, hangars and quarters for the operating personnel. A "radio range" (a directive radio beacon) will guide planes to the floating island. If the seadrome proves satisfactory a series of landing stages will be placed between New York and Europe.

These floating airports will offer to the business man the same opportunities as the municipal airport affords. Thousands of people will fly to these island airports—at first out of curiosity, later as a matter of routine, on their way to other lands. People will visit them for week-ends, or will stop over on their way to and from Europe.

Visionary? Not at all. These floating airports will become commonplace in the next few years, and developments of which we do not dream today will be practicalities ten years hence. That has been the his-

tory of Aviation—each year has transcended the expectations of the greatest optimists.

Even the Wright Brothers, famous pioneers, have been astounded by the tremendous growth of Aviation.

At Kitty Hawk, on the twenty-fifth anniversary of their first flight, I asked Wilbur Wright if he had thought, back in 1903, that Aviation would ever reach its present state of development.

“Yes,” he answered, “but it has reached, in twenty-five years, the place that Orville and I dreamed it might reach in a hundred years.”

CHAPTER IX

Aerial Exploration as a Field of Future Opportunity

EXPLORATION depends on transportation. Until a few years ago, the only ways by which explorers could seek new lands were in ships, on animals or on foot.

Christopher Columbus, Hendrik Hudson and Magellan were all seafaring men who, knowing ships and navigation, sailed strange and uncharted seas to find new continents or shorter routes to lands already known. None of these men learned much about the lands they discovered, as their observations were limited to what could be seen along the shores, or on the banks of navigable rivers. They brought back crude maps, it is true, but these were drawn from conjecture more than observation. Correct maps, drawn to scale, were not made until hundreds of years later.

Following these sea rovers in the exploration of the new world came others of a different type, men who left their ships and came ashore in the new territory with expeditionary forces prepared to penetrate into the

interior to investigate sections of this New World concerning whose riches they had heard in the Old World.

Armed with arquebus and crucifix and fired by religious zeal and an insatiable hunger for gold, these men forced their way through the jungles of sub-tropic America. Slowly and tediously with an appalling sacrifice of human life, they pushed forward, on foot and horseback. Beset with superstitious fear, hunger and privation these men still carried on with tenacious devotion to their purpose.

Their expeditions were laborious, man-killing projects which took years to complete and which accomplished little in spite of the enormous energy expended.

Landing on the shores of what is now Northern Florida, Ponce de Leon with his band penetrated the new continent as far as what we know as Southern Colorado. Here, as far as his eyes could reach, he saw mountains of reddish stone, rising as a barrier to his progress. Massive snow-capped peaks bathed in the rays of the morning sun looked to him as though they had been drenched in blood. He named these mountains the Sangre de Christo (Blood of Christ) range, and he called the land Colorado, or "Land of Red Color." Then he turned back, and on his return journey found and named that historic river, the Rio Grande.

He never got back to Spain to enjoy the fruits of his labor but succumbed to the ravages of malarial fever before he reached Florida.

In the early part of the nineteenth century Lewis and Clark established the first overland route to our Northwest territory. They were followed by Fremont, who blazed a trail through the North American wilderness — fully as strange and unknown a country then as are the ice-bound polar regions or the unexplored interiors of Tibet and Mongolia to-day.

All these men, and many more like them, advancing the frontiers of civilization through the centuries, have struggled on foot or horseback through unknown wildernesses to the far corners of the earth.

From the days of the great migrations of pre-historic men, up to the present century, man has known no other way of exploring than by traveling on foot, on the back of an animal or in a boat. From the earliest days, however, explorers have been quick to avail themselves of every new device that tends to make their work more rapid, more effectual and less costly in money and in human life. It is not surprising, therefore, that the airplane fired their zeal, as soon as its trustworthiness was proved.

In the last few years, every expedition of importance

has used aircraft. Two men in an airplane can fly over and map more territory, and do it more accurately, in a day than a ground party of several dozen surveyors can do it in a month. In one operation, the aerial explorer can view the new territory, survey and map it, locate the streams and rivers, discover the native habitations and study the flora and fauna. He brings back with him a permanent and indisputable record of what he has seen,— aerial photographs properly taken and accurate to scale.

When the expedition returns to a civilization thousands of miles away, all its work can be checked, investigated and proved by cartographers, engineers and scientists.

It was on the Dr. Alexander Hamilton Rice Scientific Exploration Expedition to the upper Amazon, in 1924 and 1925, that the airplane was first used in exploration work. Dr. Rice, Vice-President of the American Geographic Society and a Gold Medalist of the Royal Geographic Society, had, in the twenty-six years previous, made six expeditions to Northwestern Brazil, covering a considerable portion of this great wilderness and financing his expeditions out of his own funds, without thought of personal gain.

On my return to New York from Brazil, after mak-



THE EXPEDITION WENT UP THE URARICUERA AND PARIMA RIVERS, AND THE AVIATORS EXPLORED THE DIVIDE (SEE HEAVY LINE). THE DOTTED LINE IS THE APPROXIMATE ROUTE OF THE PRECEDING EXPEDITION.

ing the first flight from North to South America in the Sampaio Correia II (a twin-engined H-16 seaplane) for the New York *World*, I was asked by Mr. Henry Kelly Brent whether I was interested in flying over any more of the desolate territory of Northwestern Brazil. I replied that this vast unexplored area had always fired my imagination and that not only did I hope some day to satisfy my curiosity as to the characteristics of this country, but I also believed that the airplane would be of great service in exploring it.

Through Mr. Brent, I made contact with Dr. Rice, who explained that on his proposed expedition he wished to penetrate to some of the most inaccessible parts of this Brazilian jungle — sections which had never before been visited by white men. One objective was to determine whether or not the Orinoco River flowed both ways. For years scientists had believed that the Orinoco emptied both into the Amazon and the ocean. This theory was disproved by our expedition. We found that the great Parima range, whose peaks tower thousands of feet into the sky, separates the tributaries of the Amazon from the headwaters of the Orinoco.

All that was known of this territory was that it was covered by dense jungle, and that there were many

streams traversing it which emptied into the Amazon, but about which little else was known.

It was obvious to Dr. Rice that, if an airplane could be used for photographing the terrain and also to serve as a liaison between the advance party and the main ground crew, unusually accurate results could be obtained in a relatively short time.

All preparations for aerial operations were left in my hands. Realizing that the expedition must necessarily be self-sustaining and that elaborate repair facilities would be out of the question, I selected a Curtiss Seagull seaplane with a C-6, 160 horse power water-cooled engine as our flying equipment. This sturdy little ship was of a tried and proven design. It was sea-worthy and durable and could carry a large enough load to make it suitable for use in aerial photography as well as for liaison duty between our advance flying base and the party in the field.

Aerial photography at that time was comparatively new, having been used extensively only during the World War.

We learned that Captain A. W. Stevens, of the U. S. Army Air Service, was considered the outstanding aerial photographer experienced in such work as ours promised to be. Dr. Rice succeeded in gaining the consent

of the War Department to allow Captain Stevens leave of absence so that he could accompany Dr. Rice on this expedition.

Later experiences proved that we were extremely fortunate in having Captain Stevens with us, as he was not only an experienced airman and photographer, but also was one of the most resourceful men I have ever met. He used to carry a parachute-bag filled with a queer collection of gew-gaws and knick-knacks that seemed to have no earthly use. Yet, in any emergency, Stevens would dig down into that bag and come out with something that he could use for, or make into, a replacement for some broken part of the camera, or of the plane or motor. It was a relief to all of us to know that we had so resourceful a man with us and we grew to feel confident that Stevens could meet any situation that might confront us.

Our job was to fly ahead of the advance ground party, which traveled up the waterways in canoes paddled by Indian natives. We would fly ahead over the river ascertaining which branch to follow, selecting suitable camp sites, and making rough sketch maps on which we indicated to the advance party the route it was to take.

As it was often impossible for us to make a landing

near the ground party, we were forced to drop our sketch maps down to them in water-tight cans attached to small parachutes made of red cloth.

It was always important to let the ground party know where the Indian settlements, or molocos, were. Unless these natives were properly handled, they would become hostile and cause us no end of trouble. When the ground party knew where to expect a moloco, they could await the appearance of the savages, and could then approach them amicably and win their friendship and cooperation by gifts of bright pieces of tin, beads, knives and other trinkets.

After winning their friendship, we would trade with them for our food supply, obtaining from them jungle fruits, farina, bananas, and the meat of wild pigs and tapirs.

The natives were slow to make friends with us. They thought us winged white gods, and called our plane the "Big Bird". They were a good-natured people who, when treated properly, were kind and friendly. When aroused, however, they could — and would — fight fiercely and fearlessly. Their arms consisted of bow and arrows, spears and blow-guns. They can drop a monkey or bird out of a high tree, a hundred yards away, with a dart from a twelve-foot blow gun.

Their community huts, or molocos, were circular buildings made of mud, with thatched roofs. The entire tribe lived in a single moloco, along with their monkeys, snakes and other animal pets.

Marriage laws were simple. A man could have as many wives as he wanted, and a woman as many husbands as suited her fancy.

We seldom saw an old person. When a tribesman grew old and became a burden on the tribe, he was taken to the river bank and dispatched on his last journey — a special club being kept to do the “dispatching.”

They were not much impressed with photographs or with radio or phonographic music. Even when shown a picture of themselves, they showed no particular interest. They didn't believe it — the photograph couldn't be of them, because it wasn't as large as they were.

Music did not appeal to them unless it imitated something that they were familiar with, such as bird calls, the grunting of pigs, the barking of dogs or the crowing of a rooster.

Of all the things in the jungle which made life uncomfortable, the worst were the insects. They were a continual menace. The biting insects that flew on busy

wings infected us with jungle fever and malaria. Crawling bugs destroyed or carried off everything in sight.

We often wondered why the Indians were not troubled by the insects and eventually we found out. Salt and sugar were part of our diet, while the Indians had neither. Our perspiration evidently carried salt and sugar, which attracted the voracious little pests. A clean piece of clothing laid on the ground would be undisturbed; but should one of us inadvertently drop our shirt, trousers or shoes on the ground, nothing could be found a few hours later. The army of ants would embark on their campaign, devouring everything in their path. Attacking a shirt, for instance, each ant would clip out a piece of cloth about the size of a buckshot, with his powerful jaws, and run off with it. Several thousand others would be doing the same thing at the same time, and the garment would disappear in short order.

Swimming was unpopular in some parts of the rivers because of the flesh-eating fish, the Piranha. These savage fish are encountered only in comparatively calm water, particularly in the still water at the edge of rapids. There they lie in wait for their prey, and woe betide the man or animal that wades into the river to

drink or bathe! They will strip the flesh of man or beast to the bone.

Once we caught a Piranha on a hook with a piano-wire leader. When we landed the grunting, snapping fish, Captain Stevens put the end of a file in the creature's mouth. The Piranha closed down on the file with such force that he crushed his own jaws.

In spite of the fact that they eat flesh, they make excellent food, and are considered a delicacy by the natives.

Except on the days when weather conditions made flying impossible, we were in the air at eight o'clock. As far as the eye could reach, the dense, dark green jungle rolled to the horizon like a vast uncharted ocean.

Occasionally the presence of a good-sized stream was revealed by the reflection of the rays of the sun from its surface. Only the wider rivers could be seen, as the dense foliage of the jungle formed an impenetrable arch over the narrower streams, hiding them completely from view.

Frequently, Stevens and I wondered what would become of us should we be forced down in this trackless sea of jungle. Often we were fifty or seventy-five miles ahead of the ground party, which never could have found us, particularly if we had been injured.

At first, we carried one parachute, which Stevens wore. He wore it not through selfishness nor fear for his own safety, but because, in case of engine failure or any other emergency, he could throw the camera and film overboard and drop from the plane himself, thus lightening the load and reducing the landing speed of the plane and making a safe landing a simpler matter for me.

After a few trips on which we were equipped in this fashion, Stevens said,

“Walter, I’m not wearing the parachute again. If I wear it, and we have a forced landing and I use the ’chute, we would be separated. We’d never find each other. So I’ll stick to the ship.”

After that, in lieu of a parachute, we each carried an opium pellet large enough to put us into a dreamless sleep from which we would never waken. In both our minds, that was a better end than to lie in the jungle, injured and helpless, a prey to insects and animals.

After we had delivered our sketch maps, showing the route the ground party should follow in order to stay in the main channel of the river they were exploring, our job was to photograph the terrain we had sketched. First, we would take an oblique or panoramic

view, which would give the ground party a general idea of what they would encounter in the territory ahead of them.

Next, we took vertical pictures, flying at exactly 6,000 feet so that the photographs would be uniform and accurate to scale. Each negative, ten and a half inches square, pictured one square nautical mile of ground. We allowed each photograph to overlap the previous one by about 30%, to correct the distortion present at the extreme edge of the objective lens, and to permit matching the successive prints to produce a complete mosaic map that would be absolutely accurate.

Using the prominent landmarks (rocks, mountain peaks or bends in the river), as control points at which they set up their instruments, the engineers of the ground party checked the accuracy of the photographs and determined the exact position of these landmarks in latitude and longitude. They then checked their calculations by means of the radio time signals sent out by the United States Naval Observatory in Washington, picking up these signals by means of the short-wave radio receiving set which our radio engineer had set up.

Thomas S. McCaleb was our radio engineer — or

rather, radio *genius*. He made our receiving and broadcasting set himself, and he rigged up an old automobile generator (hooked up to an outboard motor attached to a canoe) by means of which he charged the storage batteries while the ground party was struggling upstream.

As soon as a camp site was selected for the night, McCaleb had two Indians climb into the trees, cut away the branches and fasten the ends of his aerial. In a short time he would be in communication with amateur radio stations in many parts of the world — in all parts of the United States and Britain, and even in Willington, New Zealand, 6500 miles away. Many a case of homesickness was induced or dispelled by a program of popular music broadcast from New York, to which we listened as we sat around our camp in the black Brazilian jungle.

As we approached the headwaters of the great stream, the progress of the ground party was slower and it became increasingly difficult for us to find landing places for the seaplane on the river, which had become a raging torrent.

Once while taking off, we struck a submerged rock which poked a hole in the hull of our seaplane. I circled around and signaled to John Wilshusen, our mechanic,

that something was wrong. He got the idea of what I wanted him to do and cleared all loose stones, tree limbs and other objects from a space on the beach. Then I made a fast landing close to the water's edge, thus driving the plane ashore. We spent the next few days making and installing a complete new hull-planking. This was quite a job, out there in the jungle hundreds of miles away from proper materials, without proper tools or a work-shop of any kind, but we finished it, and the expedition was able to push on, with our plane as good and serviceable as ever.

After nearly eight months, we reached the goal of our expedition and accomplished our main purpose. We ascended the Rio Negro, so named because of its black color (given it by the deposit of granite it carries) to the Rio Branco, or "White-water River."

The water of the Rio Negro is so black that it makes an excellent mirror. You can sit in a canoe, lean over the side and shave by its reflection.

On the other hand, the Branco is so clear, that its white sand bottom is clearly seen. The white bottom gives the river the appearance from which its name is derived.

We followed the Rio Branco to where the Urari-cuerra empties into it. Then we traced this river to its

source, which is the juncton of the Parima and the Aracasa rivers.

We traced the Parima to its very source — a spring on the side of a hill. We followed the Aracasa until it became a tiny mountain rill, bubbling over a rocky bed and losing itself in the dense jungle that extended northward to a range of lofty mountains.

Before the Rice Expedition of 1924 and 1925, scientists had contended that the headwaters of the Orinoco river split, one branch flowing into the Caribbean, the other into the tributaries of the Amazon. This theory was disproved by our expedition for before us were the peaks of the Sierra Parima range, which form a natural divide between the waters of the Amazon and Orinoco.

It was also rumored that there was a secret pass over this mountain range, by which invading hordes of savages made their plundering expeditions against the less warlike natives of the upper Amazon's tributaries. But no pass was visible to us as we flew along this great range, nor did our ground party discover any path through the dense jungle. The natives themselves had never been able to locate such a path, and our observations dispelled any belief in its existence.

The maps we made on this expedition are now used

trains to follow; all in a fraction of the time and at a fraction of the cost of any other method.

Large lumber companies find that the cost of timber cruising is greatly reduced by flying over the forests at a low altitude and taking pictures from which the quantity, size and kind of trees in any given section can be determined with greater accuracy than by any other method.

Power companies — telephone, telegraph, water and pipe line companies — have found that the best and cheapest way to make line route surveys is from an airplane. The route itself is selected by this means, and the photographs are accurate enough to enable engineers to estimate the materials required.

The United States and a few of the largest countries in Europe have been making geological and geographical surveys of their domains by ground parties for several hundred years, and none of them have finished the job yet.

By far the largest part of the world is poorly and inaccurately mapped. Many countries that have never before done much in this line are now entering upon extensive programs of mapping by aerial photography.

All of these activities are the more or less direct result of the successful use of aerial photography by

the Rice Expedition. I have gone into detail in regard to that expedition for the purpose of showing how valuable the results of exploration are, and how useful the airplane was to that particular party of scientists.

As a result of that exploration, which accomplished so much in so comparatively short a time through the use of an airplane, aerial exploration offers to young men who seek adventure a field of opportunity in which the monetary remuneration is large, and where renown and the privilege of associating with prominent men are additional rewards of worthy effort.

T H E E N D



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